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ADEQUACY OF SERVICES REPORT

FOR

BARRHAVEN CONSERVANCY DEVELOPMENT CORPORATION

BARRHAVEN CONSERVANCY EAST

CITY OF OTTAWA

PROJECT NO.: 16-891

JULY 30, 2020
1ST SUBMISSION
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ADEQUACY OF SERVICES REPORT FOR BARRHAVEN CONSERVANCY DEVELOPMENT CORPORATION

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1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) has been retained to prepare an Adequacy of Services Report (AES) in support of the Barrhaven Conservancy development area on behalf of Barrhaven Conservancy Development Corporation (BCDC).

The overall Conservancy land area is approximately 139.7 ha (all land use components) and is located within the City of Ottawa urban boundary in the Barrhaven ward. As illustrated in ***Figure 1***, the site is located north of the Jock River, east of Highway 416, west of Greenbank Road (and the Kennedy-Burnett Stormwater Facility), and south of both McKenna Casey Drive and Strandherd Drive.

The focus of this report is for the ***Conservancy East*** land area that is located east of the existing Foster Ditch which bisects the BCDC landholdings and consists of vacant land. The subject lands are approximately 89.41 ha in area (including all right-of-ways environmental areas and open space) and the proposed development draft plan ***Figure 2*** is provided for reference. The development area is currently zoned Development Reserve (DR) and is planned to be developed with a mix of detached single homes, townhomes, park blocks, open spaces and a road network.

An 11.2 ha triangular portion of land northeast corner of the Conservancy East area (north of the Fraser-Clarke Watercourse) is currently in the home construction stage via a separate prior development application and is referred to as "*Barrhaven Conservancy Phase 1*".

The Conservancy East development area is outside of the Jock River 100-year limit as confirmed by the Rideau Valley Conservation Authority (RVCA). Refer to the RVCA confirmation letter in ***Appendix D***.

The objective of this report is to provide sufficient detail to demonstrate that the proposed development area can be supported by municipal services.

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1.1 Existing Conditions

The ***Conservancy East*** property is relatively flat with the existing elevations ranging from 91.9 m in the north to 91 m in the south. All existing flows are either overland to the Jock River or conveyed to the Jock River by way of the Fraser-Clarke Watercourse (and its tributaries) and Borrisokane Road ditches which run through the subject property. The property is within the Jock River watershed and is under the jurisdiction of the RVCA.

1.2 Summary of Pre-Consultation

The following provides a summary of the pre-consultation:

1.2.1 Ministry of the Environment, Conservation and Parks (MECP)

Prior consultations associated with the Conservancy Phase 1 development were previously undertaken for the approval of that phase of the development area.

A pre-consultation with the local MECP office has not yet been completed for the balance of the Conservancy development area until the functional design details and requirements have been established with the City of Ottawa.

1.2.2 Rideau Valley Conservation Authority (RVCA)

Multiple consultations, analysis and submissions were coordinated with the RVCA to confirm that the development area is outside of the Jock River 100-year limit. See the RVCA documentation in ***Appendix D*** for reference.

1.3 Existing Permits / Approvals

Key approvals associated with the advancement of development of the Barrhaven Conservancy area, are presented in the following table. The most relevant approval is the Environmental Compliance Approval (ECA) for the South Nepean Collector sanitary sewer that future phases will be connecting to. The document is provided in ***Appendix A*** for reference.

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Table 1A: Existing Permits / Approvals

Agency	Approval Type	Approval Number	Remarks
Ministry of the Environment, Conservation and Parks (MECP)	Environmental Compliance Approval	# 8129-AB7LDF (June 23, 2016)	South Nepean Collector existing approval (sanitary outlet for development area)
Rideau Valley Conservation Authority (RVCA)	RVCA Letter of Permission under O.Reg. 174/06	RV5-4419	Letter of permission related to placement of fill within a regulated area.

1.4 Required Permits / Approvals

The City of Ottawa must approve detailed engineering design drawings and reports prior to future construction of the municipal infrastructure identified in this report. This will occur as part of the Plan of Subdivision application process and detailed design.

Based on pre-consultation with City staff, the additional approvals and permits listed in the following table are expected to be required prior to construction of the municipal infrastructure detailed herein. Please note that other permits and approvals may be required, as detailed in the other studies to be submitted as part of the Plan of Subdivision application (e.g. *Tree Conservation Report, Environmental Impact Statement, Phase 1 Environmental Site Assessment, Headwater Drainage Feature Assessment, etc.)*

Table 1B: Required Permits/Approvals

Agency	Permit/Approval Required	Trigger	Remarks
MECP	Environmental Compliance Approval	Construction of new sanitary and storm sewers throughout the subdivision.	The MECP will review the sanitary and storm sewer design through the City of Ottawa transfer of review process.
MECP	Environmental Compliance Approval	Implementation of oil-grit separator units for quality control.	The MECP will review the stormwater management appurtenance design through the City of Ottawa transfer of review process.
MECP	Permit to Take Water	Construction of proposed land uses (e.g. basements for residential homes) and services.	Pumping of groundwater may be required during construction, given groundwater conditions and proposed land uses and on-site/off-site municipal infrastructure.

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City of Ottawa	MECP Form 1 – Record of Watermains Authorized as a Future Alteration.	Construction of watermains throughout the subdivision	The City of Ottawa will review the watermains on behalf of the MECP through the Form 1 – Record of Watermains Authorized as a Future Alteration.
RVCA	Permit under Ontario Regulation 174/06, RVCA's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation	Grading (proposed development & potential temporary access roads) within the subject lands (i.e. crossing of Fraser-Clarke Watercourse)	Supporting applications and documentation as required through consultation with the RVCA.
RVCA	Outlets to Jock River	In conjunction with issuance of MECP applications	Supporting applications and documentation as required through consultation with the RVCA.
RVCA	Alteration to Watercourses	As necessary through consultation with the RVCA	Supporting applications and documentation as required through consultation with the RVCA.
City of Ottawa	Commence Work Notification (CWN)	Construction of new sanitary and storm sewers throughout the subdivision	The City of Ottawa will issue a commence work notification for construction of the sanitary and storm sewers once an approval is issued by the MECP.

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

The following studies were utilized in the preparation of this report.

- Ottawa Sewer Design Guidelines,
  City of Ottawa, *SDG002,* October 2012
  (City Standards)
    - Technical Bulletin ISDTB-2014-01
      City of Ottawa, February 5, 2014
      (ITSB-2014-01)
    - Technical Bulletin PIEDTB-2016-01
      City of Ottawa, September 6, 2016
      (PIEDTB-2016-01)

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- Technical Bulletin ISTB-2018-01
  City of Ottawa, March 21, 2018
  (ISTB-2018-01)
- Technical Bulletin ISTB-2018-04
  City of Ottawa, June 27, 2018
  (ISTB-2018-04)

➢ Ottawa Design Guidelines – Water Distribution
City of Ottawa, July 2010.
(Water Supply Guidelines)

- Technical Bulletin ISD-2010-2
  City of Ottawa, December 15, 2010.
  (ISD-2010-2)
- Technical Bulletin ISDTB-2014-2
  City of Ottawa, May 27, 2014.
  (ISDTB-2014-2)
- Technical Bulletin ISTB-2018-02 / ISTB-2019-02
  City of Ottawa, March 21, 2018 / July 08, 2019
  (ISTB-2018-02 / ISTB-2019-02)

➢ Design Guidelines for Sewage Works,
Ministry of the Environment, Conservation and Parks, 2008. (formerly MOECC)
(MECP Design Guidelines)

➢ Stormwater Planning and Design Manual,
Ministry of the Environment, March 2003.
(SWMP Design Manual)

➢ City of Ottawa Official Plan,
adopted by Council 2003.
(Official Plan)

➢ City of Ottawa Secondary Plan – Former Nepean – South Nepean Urban Area – Areas 9 and 10,
Adopted by Council 2003.
(Secondary Plan)

➢ South Nepean Collector: Phase 2 Hydraulics Review / Assessment Technical Memorandum
Novatech, August 2015
(Novatech SNC Memo)

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- South Nepean Collector: Phase 2 Preliminary Design Report,
  Novatech, March 2016
  (Novatech SNC Design Report)
- Strandherd Drive Widening Project, South Nepean Collector: Phase 3 Sanitary Flow Calculations
  Novatech, May 2019
  (2019 Novatech SNC Design Report)
- Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation, February 13, 2020
  (Stantec Hydraulic Analysis)
- Jock River Reach One Subwatershed Study
  Stantec, 2007
  (Jock River SWS)
- Geotechnical Investigation, Proposed Residential Development, Conservancy lands East, Ottawa, Ontario
  Paterson Group, September 24, 2019 (Project No. PG5036-1)
  (Geotechnical Report)
- Environmental Impact Statement for Barrhaven Conservancy East
  Kilgour & Associates Ltd., July 29, 2020
  (Kilgour EIS)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject property is located adjacent to the City of Ottawa's Pressure Zone (PZ) 3SW (previously known as PZ BARR). PZ SUC services the lands that are east of the subject property, as well as south of the Jock River.

The City of Ottawa has recently reconfigured the pressure zones servicing Barrhaven and the South Urban Community (SUC) in order to improve reliability and efficiency and to increase pumping capacity to accommodate for future growth in the area. There are three pumping stations servicing Zone 3SW and Zone SUC as follows: the Fallowfield Road Pumping Station (FRPS), the Barrhaven Pumping Station (BPS) and the Ottawa South Pumping Station (OSPS).

There are future trunk watermains proposed in the vicinity of the subject property (i.e. along Greenbank Road) which will provide water service to development lands to the east and south of Conservancy East. These services will be further extended to provide the requisite water supply to the development area.

3.2 Water Supply Servicing Design

Stantec Consulting Limited was retained to perform a hydraulic assessment for the Conservancy East Lands. The ***Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation (Stantec Hydraulic Analysis)*** prepared by Stantec (February 2020) is enclosed in ***Appendix B*** for reference. The analysis reviews the adjacent pressure zones and various servicing alternatives.
The subject property was deemed serviceable and the analysis offered a number of servicing alternatives that could adequately service the subject property conforming to all relevant City and Ministry of the Environment, Conservation and Parks (MECP) Guidelines and Policies.

The proposed water servicing layout is presented in ***Figure 3***. The ***Stantec Hydraulic Analysis*** indicates that there are several options to provide water servicing to support the development of the site, extending from existing or planned infrastructure. Prior coordination with City staff has indicated that the preference would be for service to be provided from the recently reconfigured South Urban Community (SUC) pressure zone (identified as Alternative '2C' in the Stantec analysis. This new zone was established in order to improve reliability and allow for accommodation of future growth. As such, the water supply network will be expanded through neighboring properties within the PZ SUC Nepean Town Centre (NTC) development area (i.e. Claridge's "Burnett Lands" development at 3370 Greenbank Road – preliminary functional design figures are provided in ***Appendix B*** for reference) with ultimate watermain concepts in line with the prior Stantec study completed titled *"Kennedy_Burnett Potable Water Master Servicing*

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Study (April 2014)" (excerpt provided in ***Appendix B***). Preliminary coordination with landowners has been undertaken in order to ensure appropriate watermain sizes will be available when those developments are advanced. At the time of detailed design, detailed hydraulic modelling will be undertaken to verify that the proposed on-site and off-site watermains are in conformance with all relevant criteria.

The following table summarizes the relevant Water Supply Design Criteria which will be employed in the design of the subject property.

Table 2: Water Supply Design Criteria

Design Parameter	Value
Extracted from Section 4: Ottawa Design Guidelines, Water Distribution (July 2010)	
Residential – Detached Single	3.4 p/unit
Residential – Townhome/ Semi	2.7 p/unit
Residential – Apartment	1.8 p/unit
Minimum Watermain Size	150 mm diameter
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
During normal operating conditions desired operating pressure is within	350 kPa and 480kPa
During fire flow operating pressure must not drop below	140 kPa
Stantec Hydraulic Analysis, Stantec, July 20, 2017 for Population Exceeding 3000 Persons	
Residential – Detached Single	180 L/cap/day
Residential – Rear Lane Town	198 L/cap/day
Residential – Back-to-Back	198 L/cap/day
Outdoor Water Demand	1049 L/unit/day (single detached)
Basic Day	Population x Demand
Max Day	Basic Day + Outdoor Water Demand

Fire Flow requirements are to be confirmed in accordance with Local Guidelines (Fire Underwriters Survey), City of Ottawa Water Supply Guidelines, and the Ontario Building Code, upon development of detailed concepts for the detached singles, townhomes, and the parks.

3.3 Water Supply Conclusion

The subject lands are have been reviewed by Stantec to confirm that servicing is feasible from the SUC pressure zone. Future watermain extensions from Nepean Town Centre development areas will facilitate servicing to the Conservancy East lands via watermain extension along the future Chapman Mills Drive extension and through the Claridge "Burnett Lands" development area. Future modelling at the detailed design stage will confirm phasing of the extensions of trunk watermains and sizing of the local watermain network. The proposed water supply design will conform to all relevant City and MECP Guidelines and Policies.

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4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

Per the ***South Nepean Collector (SNC) Wastewater Servicing Study and Functional Design Report*** by Dillon in October 2003 ***(Dillon SNC Report)***, the subject property is tributary to the South Nepean Collector (SNC) sewer as urban development land.

The SNC (previously called the Jock River Collector) sewer operates north of the subject property within Strandherd Drive prior to travelling south down a Chapman Mills Drive (CMD) and then turns eastward within the future CMD right-of-way (ROW).

The ***South Nepean Collector Phase 2: Hydraulics Review / Assessment*** memo was prepared by Novatech Engineering Consultants on August 20, 2015 ***(Novatech SNC Memo)*** to provide an update to the sanitary design flows for Phase 2 of the South Nepean Collector, as previously documented in the ***South Nepean Collector (SNC) – Functional Design Report and Update*** by Dillon in 2012 ***(Dillon SNC Report and Update)***. In addition, Novatech is also currently the engineer of record for the design and implementation of the Phase 3 extension of the SNC.

4.2 South Nepean Collector Phase 3 – Preliminary Design

The 2015 ***Novatech SNC Memo*** contemplated that the Conservancy Phase 1 development area (north of the Fraser-Clarke Watercourse) would be serviced by the 900 mm diameter SNC sewer running adjacent to the property within the future extension of CMD. This is represented by area "A6-E" within the "*Sanitary Drainage Areas and Land Use – Fig.1"* plan within the 2015 Novatech memo (note that the actual tributary area and population varied slightly).
For the Phase 3 extension of the SNC, Novatech has prepared another review of sanitary flows within their technical memorandum titled "***Strandherd Drive Widening Project***, ***South Nepean Collector Phase 3: Sanitary Flow Calculations***" May 30, 2019 ***(2019 Novatech SNC Memo).*** The memorandum along with the design sheet calculations from the Novatech memo are provided in ***Appendix C*** for reference along with DSEL annotations on key items in the figure and design sheets. The updated "*Sanitary Drainage Areas and Land Use – Fig.1" (May 2019)* plan is essentially reflective of the same tributary information that was provided in the 2015 study (the plan has been marked up to reflect the Conservancy areas as a frame of reference). The associated design sheet also reflects updated City wastewater design criteria that was not accounted for in the 2015 study and is discussed further in the following section.
Report excerpts are provided in ***Appendix C*** for the SNC Phase 2 analysis as well as draft information associated with the Phase 3 extension. The location of the SNC sewer is shown in ***Figure 4***.

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4.3 Wastewater Design

The subject property is planned to be serviced by an internal gravity sanitary sewer system that is to generally follow the local road network, with select servicing easements as required to achieve efficiencies in servicing and grading designs. The wastewater servicing plan can be seen in ***Drawing 4***.

This ***Conservancy East*** report proposes that the drainage area of the SNC sanitary sewer be expanded to include the entirety of the Conservancy property. The sewer network will connect to the off-site SNC sanitary sewer within the future CMD at existing manhole 'SANMH8' as identified in the Novatech SNC Phase 2 design Drawing No. 20 provided in ***Appendix C*** for reference (City contract number ISD14-2033). As noted in the prior section, the 2015 ***Novatech SNC Memo*** was derived flows based on the City guideline parameters of the time (namely 350 L/capita/day, infiltration allowance of 0.28 L/s/ha and commercial properties at 50,000 L/ha/d). The following table summarizes the new City design guidelines and criteria to be applied to the ***Conservancy East*** sewer design as well for the determination of the projected flows to be tributary to the SNC along the frontage of the Conservancy Phase 1 development area.

Table 3: Wastewater Design Criteria

Design Parameter	Value
Current Design Guidelines	
Residential - Single Family	3.4 p/unit
Residential – Townhome/ Semi	2.7 p/unit
Residential – Apartment	1.8 p/unit
Average Daily Demand	280 L/d/person
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial / Institutional Flows	28,000 L/ha/day
Commercial / Institutional Peak Factor	1.5
Infiltration and Inflow Allowance	0.33 L/s/ha
Park Flows	28,000 L/ha/d
Park Peaking Factor	1.0
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, and associated Technical Bulletins.	

A total area of approximately 100.11 ha is proposed to drain into the SNC trunk sewer from the Barrhaven Conservancy lands, of which 61.7 ha is comprised of the Conservancy East lands, and external areas west of the Foster Ditch. The sanitary

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drainage area information is shown in ***Figure 4*** and the design sheet is enclosed in ***Appendix C*** for reference.

Applying the City of Ottawa's wastewater design criteria to the overall development concept, the estimated peak sanitary flow from the subject property, including external flows, is ~107.44 L/s. As noted above, the subject Conservancy East lands comprises 61.7 ha of this area (including all ROWs) and represents ~57.68 L/s of these flows. The proposed internal gravity sanitary trunk sewer adequately services the subject property and does not exceed 75% capacity throughout the network.

The proposed peak sanitary flow from the subject property (including Conservancy East and external areas) to the existing SNC sanitary sewer (SANMH 8 in Novatech Drawing No. 20) is ~107.44 L/s. The addition of the Conservancy Land's peak flow to the peak design flows from the ***2019 Novatech SNC Memo*** results in an updated peak flow of 401.58 L/s to the existing SNC sewer installations downstream of existing SANMH 8. With the inclusion of the subject property, the SNC sanitary sewer along the Conservancy Phase 1 frontage would be at approximately 67% capacity and can adequately handle the entirety of the Conservancy property's proposed sanitary flows.

When reviewing the projected flows to the SNC, as derived from the *Novatech Phase 2 and Phase 3* SNC data, along with Conservancy Lands design flows, the following is summarized:

Table 4: South Nepean Collector – Projected Flow Updates

Report Reference	Projected Flows at Strandherd/CMD intersection (L/s)	Flow at Conservancy Lands Connection Point (L/s)	Difference From Original SNC Design (L/s)
2015 Novatech SNC Memo	384.7(1)	423.6	0
2019 Novatech Preliminary Phase 3 Design	282.5(2)	308.6(3)	-115.0
DSEL inclusion of Conservancy Lands tributary of ~107.81 ha	282.5	399.03(4)	-24.6

(1) See annotated Novatech design sheet "South Nepean Collector – Phase 2 & 3" (August 2015) in Appendix C and associated "Sanitary Drainage Areas and Land Use" Figure 1 dated August 2015.
(2) See annotated Novatech design sheet "South Nepean Collection Phase 3" (September 2019) in Appendix C and associated "Sanitary Drainage Areas and Land Use" Figure 1 dated May 2019
(3) Incorporating the new Phase 3 flows into the 2015 Novatech analysis
(4) See DSEL sanitary flow spreadsheet review of Novatech's SNC Phase 2 & 3 design sheet data in Appendix C.

The above table demonstrates that with the updates to the SNC design parameters and incorporation of the Conservancy Lands sanitary flows there is a net reduction of 24.6

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L/s to the SNC sewer at this location. As such, this translates into no negative impacts to the SNC sewer network downstream of this connection point.

4.4 Wastewater Servicing Conclusion

The subject property will be serviced by local sanitary sewers, an on-site trunk sanitary sewer, and the off-site SNC sanitary sewer as defined in previous reports. This AES proposes the expansion of the drainage areas from the ***2019 Novatech SNC Memo*** to include the entirety of the subject property. There is residual capacity in the downstream SNC providing sufficient capacity for the peak sanitary flows for the subject property, including external commercial and community park flows.

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5.0 STORMWATER CONVEYANCE

5.1 Existing Stormwater Drainage

The subject property is within the Jock River watershed. Per the existing topography characterized in available City of Ottawa base mapping, as well as site specific survey, all flows from the subject property are ultimately conveyed to the Jock River by a series of watercourses, sheet flow and minor ditches. The Foster Ditch, Borrisokane Road roadside ditches, and the Fraser-Clarke Watercourse are the main stormwater conveyances within the Conservancy East property that convey stormwater to the Jock River.

5.2 Proposed Stormwater Management Strategy

Various stormwater strategies were discussed within the Master Infrastructure Review (MIR) prepared in parallel with this AES. Alternatives reviewed were:

Alternative 1 – Oil and Grit Separators to Naturalized Wetlands
Alternative 2 – Stormwater Management Wetland Facilities in the Floodplain
Alternative 3 – Stormwater Management Wetland Facilities out of the Floodplain

For the purposes of this AES the preferred Alternative 1 is being advanced as per the evaluation provided in the MIR. This alternative:

- Provides for the most efficient use of land that would otherwise be occupied by multiple stormwater management ponds (i.e. four ponds, with up to ten forebays based on prior analysis, as well as sediment management areas) for water quality control. Due to the proximity of the development to the Jock River, and the site grading constraints imposed by grade raise restrictions and relatively flat topography;
- Proposes OGS units that provide the required level of quality control and have outlets that are above the 2-year event summer water levels on the Jock River;
- Utilizes naturalized wetlands for water quality polishing and thermal mitigation prior to outletting to Jock River; and
- Has straightforward system maintenance requirements via mobile vacuum trucks that are more readily achieved as opposed to the additional efforts required to maintain wet pond forebays (heavy equipment for sediment removal and relocation).

The design for the site proposes to have stormwater flows conveyed through the subject property via an underground sewer network. The stormwater runoff will be treated to provide an Enhanced Level of Protection (80% total suspended solids (TSS) removal) before ultimately being released into the Jock River as per the ***Jock River Reach One Subwatershed Study*** prepared by Stantec in 2007 ***(Jock River SWS)***.

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The proposed stormwater design layout is shown on ***Drawing 3*** with the stormwater management design consisting of:

- A storm sewer system designed to capture at least the minimum design capture events in accordance with the amendment to the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer (Technical Bulletin PIEDTB-2016-01);
- Multiple oil and grit separators (OGS) designed to provide the required Enhanced Level of Protection per MECP guidelines, via treatment of the stormwater captured by the storm sewer network;
- OGS units will discharge to naturalized wetlands within the floodplain for additional water quality polishing and thermal mitigation prior to outletting to Jock River ;
- Inverts of outlets of OGS units are set at the 2-year summer water levels of the Jock River with a bypass design for the 100-year storm;
- An on-site road network designed to maximize the available storage in the on-site road network for the 100-year design event, where possible, with controlled release of stormwater to the minor storm system; and
- An overland flow route designed to safely convey stormwater runoff flows in excess of the on-site road storage.

Although quantity control is not required for the Jock River, as per the ***Jock River SWS***, the quantity of stormwater runoff exiting from the subject property will be minimized by optimizing on-site storage in the sags of the proposed road network, which in turn minimizes the size of downstream storm sewer infrastructure.

5.3 Post-Development Stormwater Management Targets

Stormwater management requirements for the proposed alternative Stormwater management scheme have been adopted from the ***Jock River SWS***, ***City Standards***, and the ***MECP SWMP Manual***.

Given the general criteria mentioned above, the following specific standards are anticipated for stormwater management within the subject property:

- Enhanced quality treatment will be provided for stormwater runoff from the subject property, corresponding to a long-term average TSS removal efficiency of 80%, as defined by the MECP prescribed treatment levels;
- Downstream receiving watercourses will be assessed for responses to planned stormwater management outflows, and stabilization mitigation measures will be planned as required;

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- Storm sewers on local roads are to be designed to provide at least a 2-year level of service without any ponding per the City's latest Technical Bulletin PIEDTB-2016-01;
- Storm sewers on collector roads are to be designed to provide at least a 5-year level of service without any ponding per the City's latest Technical Bulletin PIEDTB-2016-01;
- For less frequent storms (i.e. larger than 2-year or 5-year), the minor system sewer capture will be restricted with the use of inlet control devices to prevent excessive hydraulic surcharges;
- Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 6.0 m/s;
- For the 100-year storm and for all roads, the maximum depth of water (static and/or dynamic) on streets, rearyards, public space and parking areas shall not exceed 0.35 m at the gutter;
- The major system shall be designed with sufficient capacity to allow the excess runoff of a 100-year storm to be conveyed within the public ROW, or adjacent to the ROW, provided the water level does not touch any part of the building envelope; must remain below all building openings during the stress test event (100-year + 20%); and must maintain 15 cm vertical clearance between spill elevation on the street and the ground elevation at the nearest building envelope;
- Flow across road intersections shall not be permitted for minor storms (generally 5-year or less);
- When catchbasins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas. A minimum of 30 cm of vertical clearance is required between the rear yard spill elevation and the ground elevation at the adjacent building envelope; and
- The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads.

5.3.1 Quality Control

Per the ***Jock River SWS,*** Enhanced quality treatment will be provided for stormwater runoff from the subject property, corresponding to a long-term average TSS removal efficiency of 80%, as described by the MECP prescribed treatment levels.

5.3.2 Quantity Control

As noted in the ***Jock River SWS***, quantity control is not required for the Jock River, however, some quantity control may be provided by erosion storage, as erosion thresholds for any watercourses/outlets will be respected where required.

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5.4 Stormwater Management Design

As shown on ***Drawing 3***, the proposed stormwater management design consists of multiple (ten) OGS units throughout the southern boundary of the property, discharging to the Jock River via naturalized wetlands. By way of an MECP Certificate of Technology Assessment and manufacturer's design report, the OGS units must prove compliance with Enhanced Level of Protection requirements, with specific drainage area parameters for each area.

The manufacturer's reported efficiency of TSS removal of the oil/grit separator is expected to be based on a 'fine distribution' particle size distribution in conformance with the following table, unless otherwise approved by DSEL, City of Ottawa, RVCA, and MECP. The particle size distribution is the generic particle size distribution accepted by the City of Toronto per the *Wet Weather Flow Management Guidelines* (City of Toronto, 2006) as a typical average stormwater particle size distribution, and is an excerpt from Table 3.3 of the *Stormwater Management Practices Planning and Design Manual* (MOECC, 1994).

Table 5: Typical Stormwater Particle Size Distribution & Settling Velocities (Source: *Stormwater Management Practices Planning and Design Manual,* MOECC, 1994)

Particle Size (microns) (NURP 1983)	% of Particle Mass	Average Settling Velocities (m/s)
< 20	0 - 20	0.00000254
20 - 40	20 - 30	0.00001300
40 - 60	30 - 40	0.00002540
60 - 130	40 - 60	0.00012700
130 - 400	60 - 80	0.00059267
400 - 4000	80 - 100	0.00550333

To allow for flexibility as detailed design advances, it is proposed that any OGS unit can be selected, given that it:

- Meets the requirements set out in the preceding sections;
- Ensures no significant negative impact on the upstream storm sewer system – to be determined via hydraulic modelling at detailed design; and
- Demonstrates suitability for meeting Enhanced water quality targets via a MECP Certificate of Technology Assessment.

The preliminary OGS units proposed in the following table have been sized to treat the stormwater runoff for the tributary areas noted in order to meet MECP Enhanced Level

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of Protection criteria prior to discharge to the Jock River via naturalized wetlands as shown on ***Drawing 3***. The OGS total suspended removal rates and units details have been attached for reference in ***Appendix D***.

Table 6: OGS Unit ID and Design Characteristics

Area and Unit ID (2)	Drainage Area Target (ha)	Estimated Weighted C Value	Unit Treatment Capacity (L/s)	Unit Model (1)
Area 1 – OGS1	6.24	0.65	170	CDS Model 4040
Area 2 – OGS2	5.82	0.65	170	CDS Model 4040
Area 3 – OGS3	2.63	0.65	68	CDS Model 3025
Area 4 – OGS4	6.66	0.65	170	CDS Model 4040
Area 5 – OGS5	8.66	0.65	255	CDS Model 5640
Area 6 – OGS6	5.92	0.65	170	CDS Model 4040
Area 7 – OGS7	9.30	0.65	396	CDS Model 5653
Area 8 – OGS8	5.42	0.65	170	CDS Model 4040
Area 9 – OGS9	4.18	0.65	108	CDS Model 3035
Area 10 – OGS10	3.91	0.65	108	CDS Model 3035

(1) Providing at minimum 80% TSS removal
(2) See ***Drawing 3*** for OGS unit locations

5.5 Proposed Minor System

The subject property will be serviced by an internal gravity storm sewer system that is to generally follow the local road network and proposed servicing easements as required. The drainage will be conveyed within the underground piped sewer system to the appropriate OGS units and wetland outlets.

Street catchbasins will collect drainage from the streets and front yards, while rear yard catchbasins will capture drainage from backyards. Perforated catch basin leads will be provided in rear yards, except the last segment where it connects to the right-of-way which will be solid pipe, per City standards.

The preliminary rational method design of the minor system captures drainage for storm events up to and including the 2-year (local) and 5-year (collector) event assuming the use of inlet control devices (ICD) for all catchbasins within the subject property. The

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following summarizes the standards that will be employed in the detailed design of the storm sewer network. The preliminary drainage area information can be found in ***Drawing 3*** and rational method design sheets are provided in ***Appendix D***.

Table 7: Storm Sewer Design Criteria

Design Parameter	Value
Minor System Design Return Period	1:2 year (PIEDTB-2016-01) for local roads, without ponding 1:5 year (PIEDTB-2016-01) for collector roads, without ponding 1:100 year (PIEDTB-2016-01) for arterial road, without ponding
Major System Design Return Period	1:100 year
Intensity Duration Frequency Curve (IDF) 2-year storm event: A=732.951 | B=6.199 | C=0.810 5-year storm event: A = 998.071 | B = 6.053 | C = 0.814	$i = \frac{A}{(t_c + B)^C}$
Minimum Time of Concentration	10 minutes
Rational Method	$Q = CiA$
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Runoff coefficient for paved and roof areas	0.9
Runoff coefficient for landscaped areas	0.2
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n' for pipe flow	0.013
Minimum Depth of Cover	1.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.8 m/s
Maximum Full Flowing Velocity	6.0 m/s
Clearance from 100-Year Hydraulic Grade Line to Building Opening	0.30 m
Design Parameter	**Value**
Max. Allowable Flow Depth on Municipal Roads	35 cm above gutter (PIEDTB-2016-01)
Extent of Major System	To be contained within the municipal ROW or adjacent to the ROW provided that the water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100-year + 20%) and 15cm vertical clearance is maintained between spill elevation on the street and the ground elevation at the nearest building envelope (PIEDTB-2016-01)
Stormwater Management Model	DDSWMM (release 2.1), SWMHYMO (v. 5.02) and XPSWMM (v. 10)

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Model Parameters	Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm
Imperviousness	Based on runoff coefficient (C) where Percent Imperviousness = (C - 0.2) / 0.7 x 100%.
Design Storms	Chicago 3-hour Design Storms and 24-hour SCS Type II Design Storms. Maximum intensity averaged over 10 minutes.
Historical Events	July 1st, 1979, August 4th, 1988 and August 8th, 1996
Climate Change Street Test	20% increase in the 100-year, 3-hour Chicago storm
Extracted from City of Ottawa Sewer Design Guidelines, October 2012, and ISSU, and based on recent residential subdivisions in City of Ottawa.	

The peak design flows are calculated based on an average predicted runoff coefficient (C-value) of 0.67 and 0.80 for the development areas and 0.25 for the grassed areas. As detailed design progresses, the runoff coefficients will be refined to reflect the proposed building envelopes, driveways and other details.

There are several trunk sewers proposed and the peak flows are described for the trunk sewers which correspond to the stormwater management design areas as follows:

Table 8: Minor System Trunk Sewer Outlets

Area	OGS Unit	Trunk Sewer Outlet to OGS	Peak Flow (L/s)
1	OGS 1	900 mm diameter @ 0.20%	612
2	OGS 2	900 mm diameter @ 0.15%	595
3	OGS 3	675 mm diameter @ 0.15%	264
4	OGS 4	975 mm diameter @ 0.15%	641
5	OGS 5	1050 mm diameter @ 0.15%	820
6	OGS 6	900 mm diameter @ 0.15%	571
7	OGS 7	1200 mm diameter @ 0.20%	1363
8	OGS 8	900 mm diameter @ 0.20%	659
9	OGS 9	825 mm diameter @ 0.15%	421
10	OGS 10	825 mm diameter @ 0.15%	408

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The storm sewers tributary to the OGS units and associated peak flows are detailed in the rational method design sheet, enclosed in ***Appendix D***.

The peak design flows are calculated based on an average predicted runoff coefficient (C-value) of 0.65 for the development areas and 0.40 for the grassed areas. As detailed design progresses, the runoff coefficients will be refined to reflect the proposed building envelopes, driveways and other details.

The preliminary conceptual servicing plan is shown on ***Drawing 2*** in ***Drawings***. As detailed design progresses, alignment and sizing of local storm sewers will be confirmed and additional servicing easements may be required, which may trigger amendments to the proposed lot fabric in the concept plan. The preliminary sanitary and storm trunk plan and profiles are shown on ***Drawing 5*** and ***Drawing 6*** in ***Drawings***.

5.5.1 Hydraulic Grade Line Analysis

A detailed hydraulic grade line (HGL) modelling analysis will be completed for the proposed system at the detailed design level, based on the 100-year 3-hour Chicago, 12-hour SCS, and 24-hour SCS design storms, including historical design storms and climate change stress test as required. Detailed grading design and storm sewer design will be modified as required to achieve the freeboard requirements set out in ***Section 5.3*** (per PIEDTB-2016-01).

5.6 Proposed Major System

Major system conveyance, or overland flow, will be provided to accommodate flows in excess of the minor system capacity. Overland flow is accommodated by generally storing stormwater up to the 100-year design event in road sags then routing additional surface flow along the road network and service easements towards the proposed stormwater outlets, discharging to the Jock River, as shown on ***Drawing 1***. The grading design includes a saw-toothed-road design with 0.10% minimum grade from high point to high point in order to maximize available surface storage for management of flows up to the 100-year design event where possible.

5.7 Foundation Drainage (Sump Pumps)

Due to the grade raise restrictions and the proposed storm and sanitary drainage schemes, the road centerlines do not allow for standard basements with a gravity connection to the storm sewer system. As such, because of the constraints on the subject property, sump pumps are proposed to be installed for all residential blocks and residential lots.

The City of Ottawa issued Technical Bulletin *ISTB-2018-04* and *2019-02* for the amendment of the *Ottawa Design Guidelines – Sewer, Second Edition,* October 2012

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with respect to the screening criteria for the use of sump pump systems for foundation drainage in Greenfield developments on sites with clay soils. Similar to the development of Conservancy Phase 1, the Conservancy East site has also been assessed as meeting the required criteria for the use of sump pumps.
One of the screening criterion is with respect to the hydraulic grade line (HGL) for the development wherein the system should be reviewed to demonstrate that the HGL cannot reasonably be lowered any further due to outlet restrictions. The site grading is constrained by the close proximity of the Jock River, which is the receiver of stormwater outflows, and is also constrained by grade raise restrictions for the property.

For the Barrhaven Conservancy East lands the grade raise restriction varies between 1.4 m and 2.2 m. Paterson's permissible grade raise plan is contained in ***Appendix E*** for reference (See Section 6 for discussion). Further investigations on the property and potential surcharging or lightweight fill (LWF) underneath garages could increase the permissible grade raise and will be investigated further as part of the detailed design.

The functional grading plan for the subdivision has been prepared with the grade raise restrictions in mind with grades being kept as low as possible.

The proposed centerline of road grades, and subsequently the house grades, do not allow for standard basements with a gravity connection to the storm sewer system. As such, the subdivision will be serviced entirely by sump pumps due to site constraints imposed by grade raise restrictions, HGL elevations and the proximity to the Jock River stormwater outlet.

5.8 Low Impact Development (LID) - Infiltration

The following Low Impact Development (LID) techniques could be considered for implementation, where possible, as part of detailed design (noting that they have to be weighed against the objectives of the City's sump pump technical bulletins):

- Rear-yard swales should be designed with minimum grades where possible, to promote infiltration;
- Rear-yard catchbasin leads should be perforated (except for the last segment connecting to the storm sewer within the ROW), to promote infiltration; and,
- Where eavestroughs are provided on residential units, they are to be directed to landscaped surfaces, to promote infiltration.
- Furthermore, the following techniques can be examined as part of detailed landscaping design of the park block; and,
- Micro-grading can be considered to promote infiltration.

Generally, the development area is not a strong candidate for LID techniques beyond those proposed above due to the existing clay soils and high groundwater levels.

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5.9 Existing Watercourses

5.9.1 Foster Ditch

The Foster Ditch borders the western boundary of the Conservancy East development area. It originates south of Fallowfield Road, west of Cedarview Road and flows south until it converges with the Jock River South of McKenna Casey Drive. The ditch is approximately 3200 m long and has been artificially straightened. This non-municipal drain is a fish bearing tributary of the Jock River with approximately 335 ha of catchment area. The surrounding land use is urban and vacant lands. Riparian vegetation is very sparse consisting of mostly grasses with a few shrubs.

As noted in the ***Jock River SWS***, to ensure protection of the aquatic habitat north of the Jock River, a development setback should be provided for all of the tributaries. Further studies will determine the// development setback, which will be the greater of: 1) regulatory floodplain; 2) meander belt width; and 3) aquatic setback, whichever is greater.

5.9.2 Fraser-Clarke Watercourse

The Fraser-Clarke Watercourse (FCW) is located along the norther portion of the Conservancy East development area (east of Borrisokane Road). The watercourse begins east of Borrisokane Road and enters the Jock River west of Greenbank Road. It is approximately 1900 m in length. The catchment area of the watercourse has undergone significant changes in recent years with the urbanization of the lands north of the drain and inclusion of the outlet from the Kennedy-Burnett stormwater facility which enters the watercourse approximately 300 m from its confluence with the Jock River. The current channel only received flows from lands east of Borrisokane Road. Riparian vegetation consists mainly of grasses with a few shrubs. The downstream portion of the watercourse is planned to be improved in association with the advancement of the Conservancy Phase 1 development on the north side of the FCW. The improvements are anticipated to be completed in the summer of 2020.

As noted in the ***Jock River SWS***, to ensure protection of the aquatic habitat north of the Jock River, a development setback should be provided for all of the tributaries. Further studies will determine the development setback, which will be the greater of: 1) regulatory floodplain; 2) meander belt width; and 3) aquatic setback, whichever is greater.

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5.10 Stormwater Servicing Conclusions

The stormwater runoff is designed to be captured by an internal gravity sewer system that is to convey flows to ten OGS unit locations that will provide the required Enhanced Level of quality control protection treatment. Downstream of the OGS outlets will be naturalized wetland areas that will provide additional water polishing (over and above the required Enhanced Level provided by the OGS units) and thermal mitigation prior to discharge to the Jock River. Quantity control is not required for the Jock River. Notwithstanding, some quantity control by means of erosion storage will be included.

A detailed Hydraulic Grade Line (HGL) modelling analysis will be completed for the proposed system at the detailed design level. Due to the grade raise restrictions and the proposed storm and sanitary drainage schemes, the road centerlines do not allow for standard basements with a gravity connection to the storm sewer system. As such, because of the constraints on the subject property, sump pumps are proposed to be installed for all residential blocks and residential lots.

The Conservancy East development area is outside of the Jock River's regulatory floodplain area.

Appropriate setbacks from existing watercourse are incorporated into the draft plan based on advancement/finalizing of studies to assess the various determining criteria.

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6.0 GRADING

A site grading scheme has been developed to optimize earthworks and provide major system conveyance to the receiving outlets – OGS units and naturalized wetland facilities, which outlet to the existing Jock River drainage network. The proposed grading can be found in ***Drawing 1*** in ***Drawings***.

The development area is outside of the Jock River regulatory flood plain limits. The site grading will be a minimum of 0.50m above the 100-year regulatory limit event of the Jock River.

6.1 Geotechnical Conditions

Paterson completed a geotechnical investigation for the Conservancy East lands as follows:

- Geotechnical Investigation – Proposed Residential Development, Conservancy Lands East (Paterson Group, September 24, 2019);

The existing ground surface across the site is relatively level with approximate ground surface elevation varying between 91 m and 92 m. The subsurface profile generally consists of an approximate 50 mm to 460 mm thick layer of topsoil underlain by a silty clay deposit.

Due to the presence of a silty clay deposit, permissible grade raise restrictions are recommended for this site. The recommended permissible grade raise varies between 1.4 m in the northwest and 2.2 m in the southeast. Figure PG5036-2 '*Permissible Grade Raise Plan'* by Paterson is enclosed in ***Appendix E*** for reference. At the time of detailed design, detailed review and signoff by a licensed Geotechnical Engineer will be required. Where grade raises exceed the permissible levels the Engineer will recommend appropriate measures to mitigate where required (i.e. light weight fill or pre-consolidation etc).

The following additional grading criteria and guidelines will be applied to detailed design, per ***City of Ottawa Guidelines***:

- Driveway slopes will have a maximum slope of 6%;
- Grading in grassed/landscaped areas to range from 2% to 3:1, with terracing required for slopes larger than 7%;
- Swales are to be 0.15m deep with 3:1 side slopes unless otherwise indicated on the drawings; and,
- Perforated pipe will be required for drainage swales if they are less than 1.5% in slope.

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The geotechnical analysis of the site, published under separate cover in support of the development applications, provides additional information about the suitability of the site for the proposed services and grading scheme. At the time of detailed design, detailed review and signoff by a licensed Geotechnical Engineer will be required.

7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. The extent of erosion losses is exaggerated during construction where vegetation has been removed and the top layer of soil becomes agitated.

Prior to topsoil stripping, earthworks or underground construction, erosion and sediment controls are implemented and will be maintained throughout any construction phase.

The following specific recommendations to the Contractor will be included in contract documents.

- Limit extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with plastic or synthetic mulches.
- Install silt fence to prevent sediment from leaving the site and entering existing watercourses, and clean and maintain throughout construction.
- Install catchbasin inserts during construction to protect from silt entering the storm sewer system.
- Install mud mats in order to prevent mud tracking onto adjacent roadways.
- No refueling or cleaning of equipment near existing watercourses.
- No material stockpiles within 30m of existing watercourses, unless otherwise permitted by RVCA and City of Ottawa.
- Provide sediment traps and basins during dewatering.
- Plan construction at proper time to avoid flooding.
- The Contractor will, at every rainfall, complete inspections to ensure proper performance.
- Erosion and sediment controls will remain in place until the working areas have been stabilized and re-vegetated.

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8.0 UTILITIES

Utility services extending to the site may require connections to multiple existing infrastructure points: consultation with Enbridge gas, Hydro Ottawa, Rogers, and Bell is required as part of the development process to confirm the servicing plan for the subject lands.

9.0 CONCLUSION AND RECOMMENDATIONS

This AES provides details on the planned on-site municipal services for the subject property and demonstrates that adequate municipal infrastructure capacity is expected to be available for the planned development of the subject property.

- The subject lands have been reviewed by Stantec to confirm that servicing is feasible by City of Ottawa PZ SUC. Several alternatives were presented to confirm that servicing is feasible. The water supply network will be expanded through neighbouring properties to meet the water demands of the proposed concept plan, via the trunk watermain network and local watermains identified. Detailed modelling will confirm phasing of the extensions of trunk watermains and sizing of the local watermain network.

- Sanitary service is to be provided to the subject property via the off-site South Nepean Collector (SNC) trunk sanitary sewer. With the inclusion of the subject property, the SNC sanitary sewer will have projected flows that are lower than the previously estimated flows assessed during the Phase 3 extension of the SNC sanitary trunk due to changes in City design criteria. The SNC can adequately handle the entirety of the subject property proposed sanitary flows.

- Stormwater service is to be provided by capturing stormwater runoff by an internal gravity sewer system that will convey flows to proposed OGS units for Enhanced Level of Protection quality control treatment which then outlet to naturalized wetland areas for further water polishing and thermal mitigation prior to discharge to the Jock River. Quantity control is not required for the Jock River.

- A detailed Hydraulic Grade Line (HGL) modelling analysis will be completed for the proposed system at the detailed design level.

- Sump pumps are proposed to be installed for all units within residential blocks and lots;
- The proposed servicing and grading plans are expected to meet all City, RVCA, and MECP requirements as set out in background studies and current standards.
- Prior to detailed design of the infrastructure presented in this report, this AES will require approval under the Planning Act as supporting information for the Plan of

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Subdivision application. Project-specific approvals are also expected to be required for the infrastructure presented in this report from the City of Ottawa, MECP, and Rideau Valley Conservation Authority, among other agencies.

Prepared by,
David Schaeffer Engineering Ltd.

LICENSED PROFESSIONAL ENGINEER
K.L. MURPHY
90475369
July 31/20
PROVINCE OF ONTARIO

Per: Kevin L. Murphy, P.Eng.

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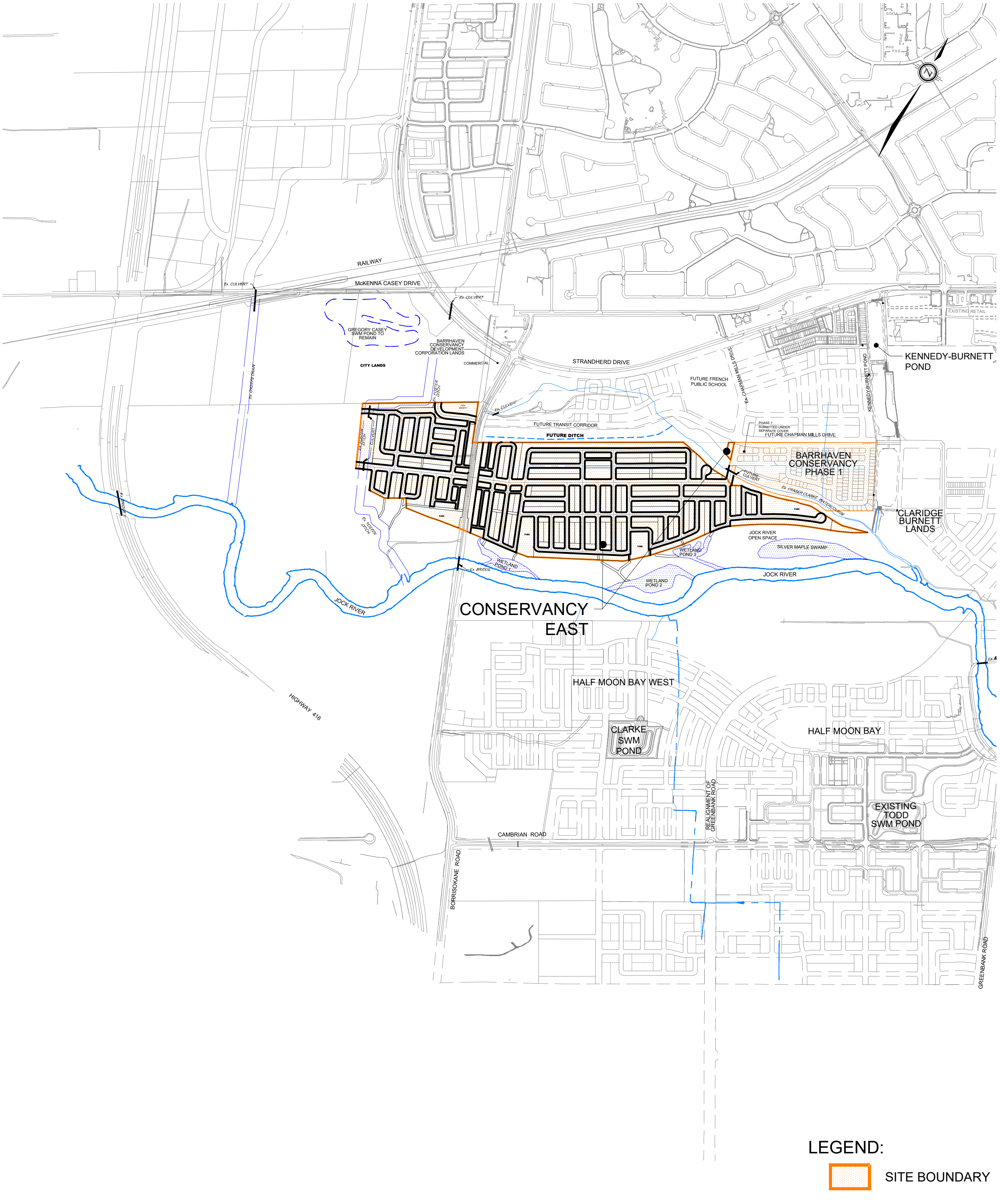
2020-07-30_AES_Conservancy East_1st_Subm.doc

FIGURES & DRAWINGS



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BARRHAVEN CONSERVANCY EAST

KEY PLAN

CITY OF OTTAWA

DATE:	JULY 2020
SCALE:	1:20000
PROJECT No.:	16-891
FIGURE:	1

LEGEND

SITE BOUNDARY

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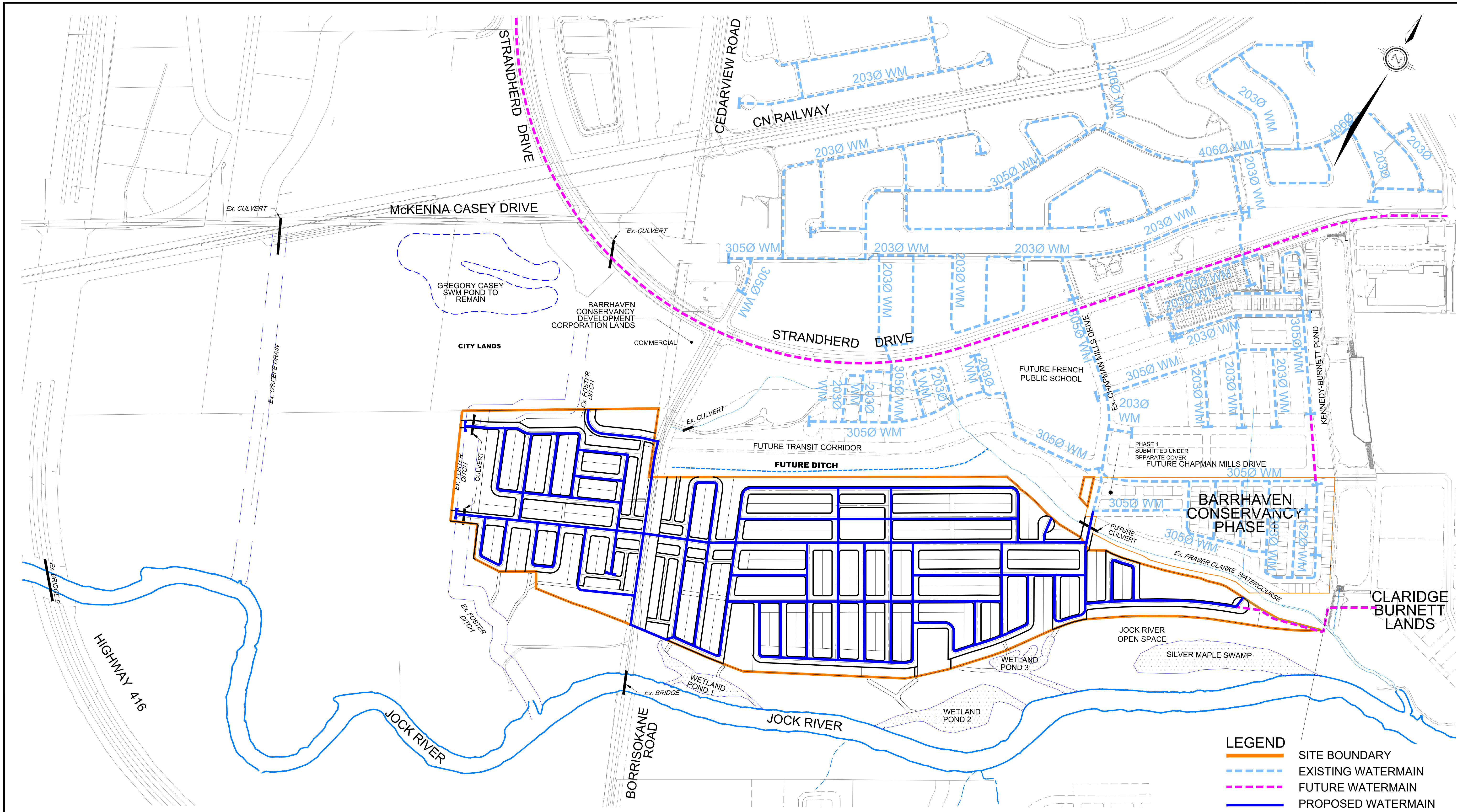
BARRHAVEN CONSERVANCY EAST
SUBDIVISION PLAN
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	NTS
DATE:	JULY 2020
FIGURE:	2



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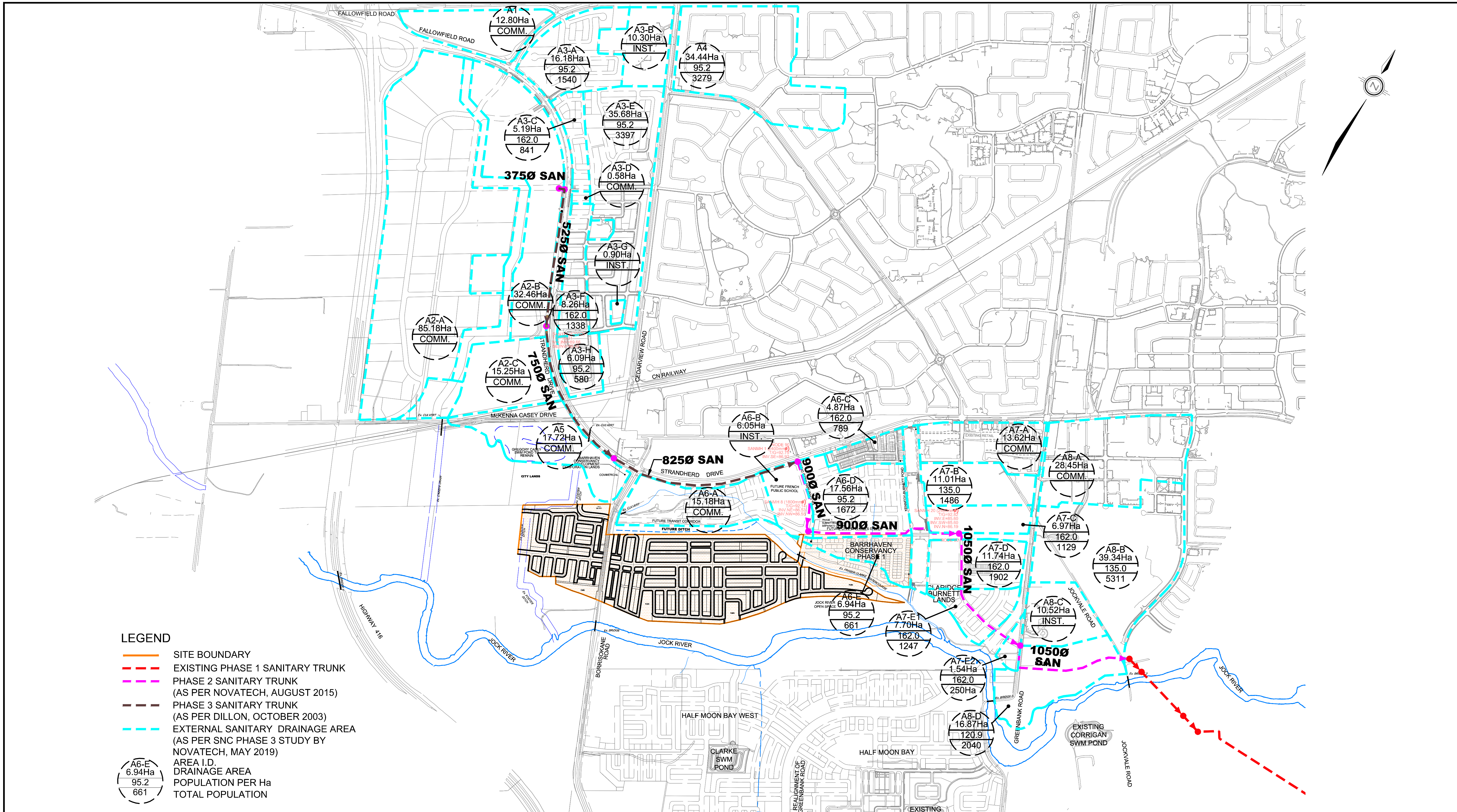
BARRHAVEN CONSERVANCY EAST
WATERMAIN SERVICING PLAN
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	1:8000
DATE:	JULY 2020
FIGURE:	3



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BARRHAVEN CONSERVANCY EAST
EXTERNAL SANITARY SERVICING
CITY OF OTTAWA

PROJECT No.:	16-891
SCALE:	1:18000
DATE:	JULY 2020
FIGURE:	4

LEGEND

- SITE BOUNDARY
- STORM OVERLAND FLOW ARROW
- PROPOSED CENTERLINE ELEVATION
- PROPOSED ELEVATION
- EXISTING ELEVATION
- EXISTING CONTOUR ELEVATION

CUT-FILL DEPTH ALONG CENTER LINE:

CUT DEPTH (m)	FILL DEPTH (m)
0 - 1	0 - 1
1 - 2	1 - 2
2 - 3	2 - 3
> 3	> 3

NOTES:

1. LOW FLOW CHANNEL ELEVATION TO BE VERIFIED IN THE FIELD AT ALL ROAD AND SEWER CROSSING LOCATIONS.
2. DETAILED DESIGN ROAD GRADES WILL BE NO LOWER THAN THE ELEVATIONS ILLUSTRATED ON THIS PLAN, AND WILL RISE AND FALL BY APPROXIMATELY 0.4m ABOVE THE TROUGH GRADES PRESENTED ON THIS PLAN.
3. EARTHWORKS VOLUMES ARE BASED ON THE MEDIAN ROAD GRADES, WHICH ARE ESTIMATED TO BE 0.2m HIGHER THAN THE TROUGH GRADES PRESENTED ON THIS PLAN.
4. ENGINEERED FILL VOLUMES ARE BASED ON THE MEDIAN ROAD GRADES, WHICH ARE ESTIMATED TO BE 0.2m HIGHER THAN THE TROUGH GRADES PRESENTED ON THIS PLAN.
5. MAXIMUM GRADE RAISE IS BASED ON THE CREST ROAD GRADES, WHICH ARE ESTIMATED TO BE 0.4m HIGHER THAN THE TROUGH GRADES PRESENTED ON THIS PLAN.
6. EXISTING ELEVATIONS SHOWN ARE FROM TOPOGRAPHIC SURVEY PROVIDED BY JD BARNES, DATED NOVEMBER 2019. HOWEVER, ALL LIGHTWEIGHT FILL TO DETERMINED FROM TOPOGRAPHIC SURVEY PROVIDED BY JD BARNES, DATED APRIL 2019.

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BARRHAVEN CONSERVANCY EAST
CONCEPTUAL GRADING PLAN
CITY OF OTTAWA

PROJECT No. :	16-891
SCALE:	1:3000
DATE:	JULY 2020
DRAWING No.	1

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BARRHAVEN CONSERVANCY EAST
CONCEPTUAL SERVICING PLAN
CITY OF OTTAWA

PROJECT No. :	16-891
SCALE:	1:3000
DATE:	JULY 2020
DRAWING No.	2

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BARRHAVEN CONSERVANCY EAST
STORM TRIBUTARY AREA
CITY OF OTTAWA

PROJECT No. :	16-891
SCALE:	1:3000
DATE:	JULY 2020
DRAWING No.	3

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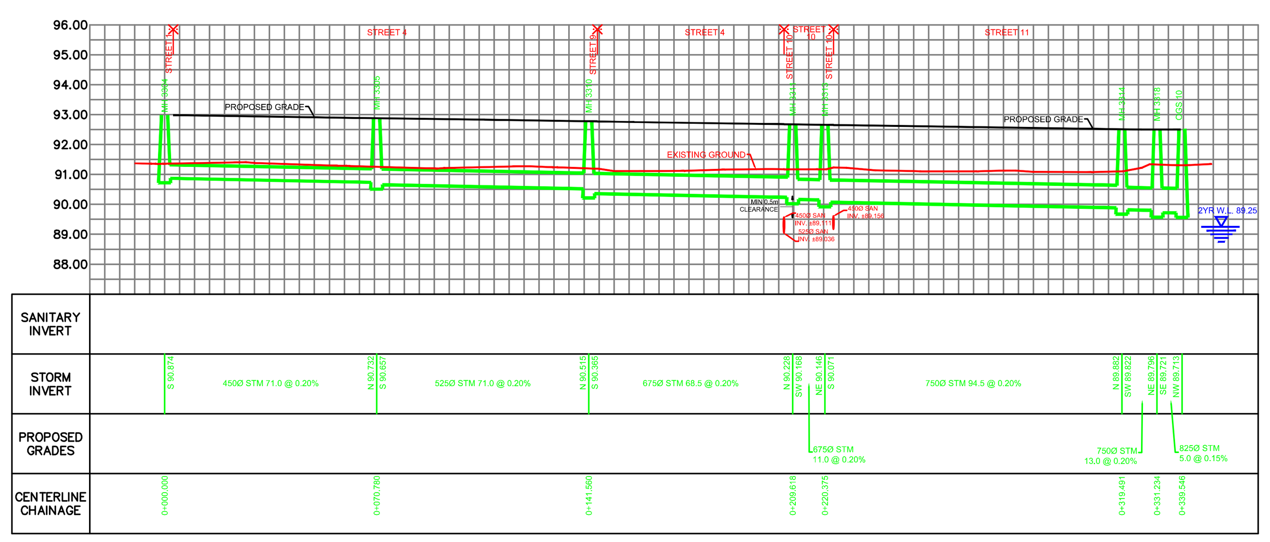
BARRHAVEN CONSERVANCY EAST
SANITARY TRIBUTARY AREA
CITY OF OTTAWA

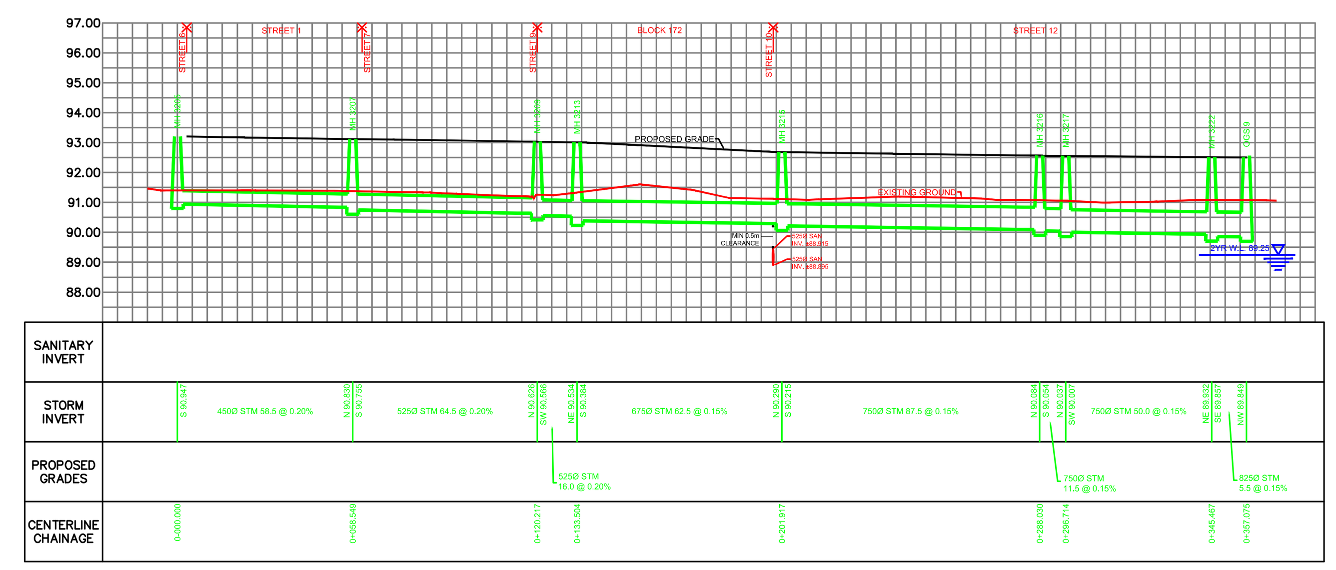
PROJECT No. :	16-891
SCALE:	1:3000
DATE:	JULY 2020
DRAWING No.	4

SANITARY TRUNK 1

STORM TRUNK 10



STORM TRUNK 9



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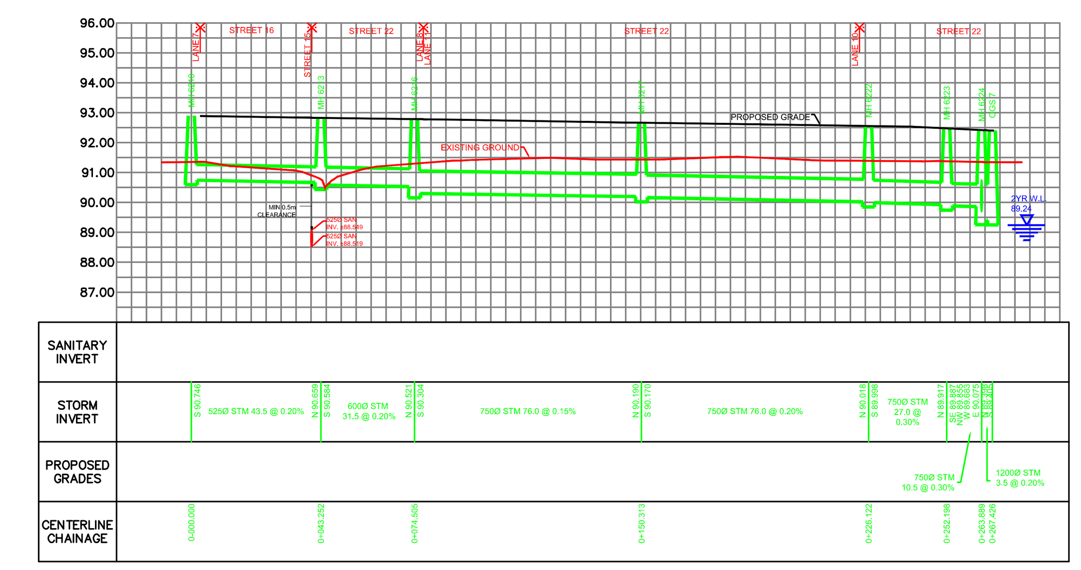

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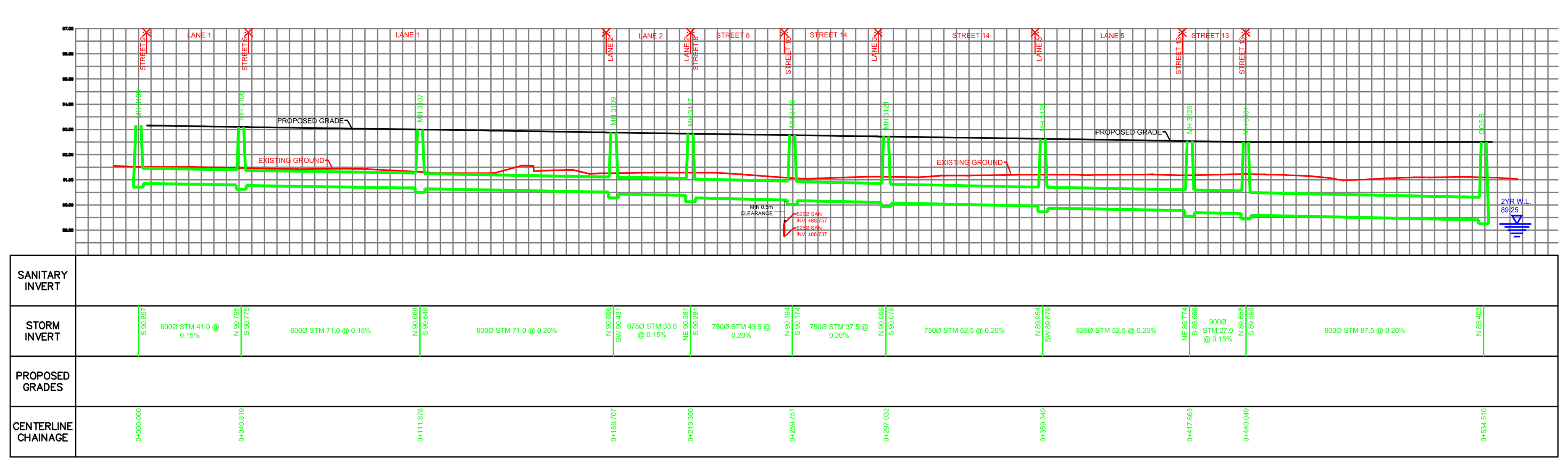
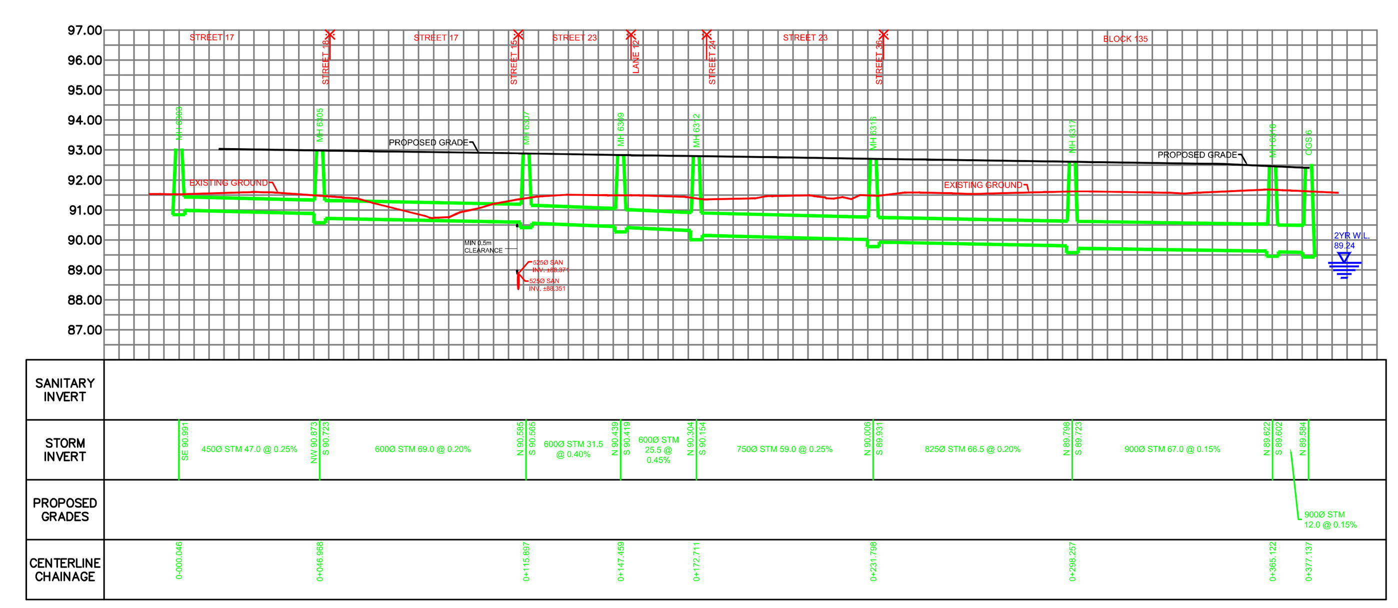
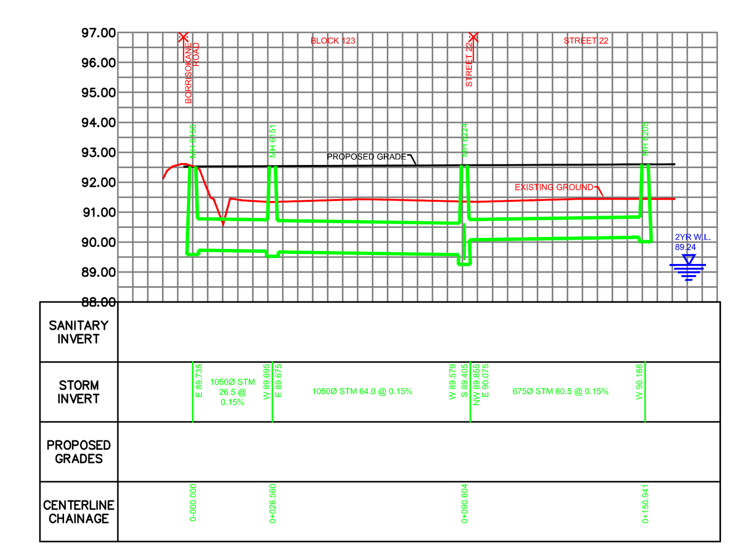


STORM TRUNK 6



STORM TRUNK 7A



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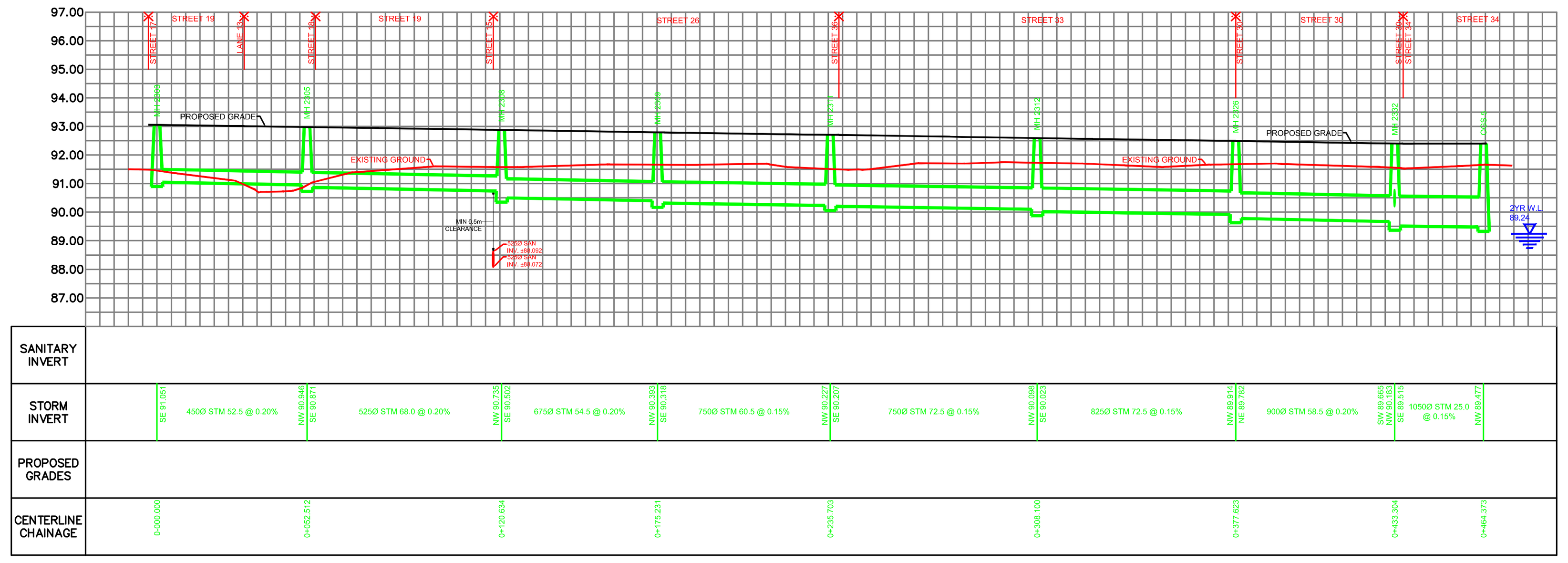
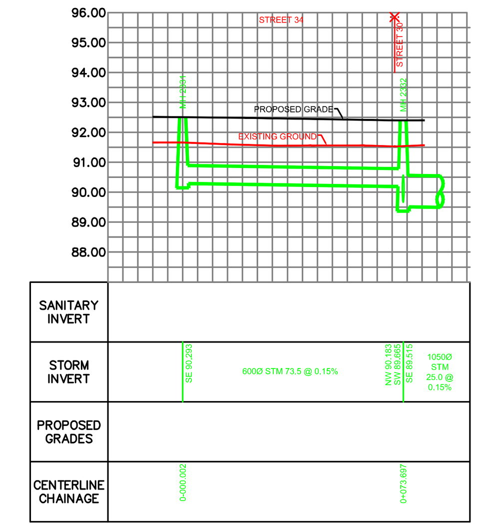
BARRHAVEN CONSERVANCY EAST
SANITARY AND STORM TRUNK PROFILES
CITY OF OTTAWA

PROJECT No. :	16-891
SCALE:	1:2000
DATE:	JULY 2020
DRAWING No.	5

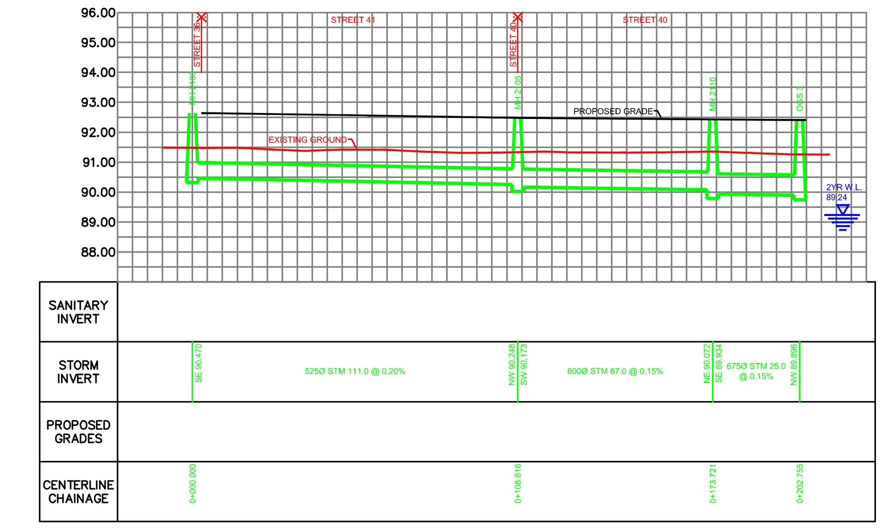
STORM TRUNK 5



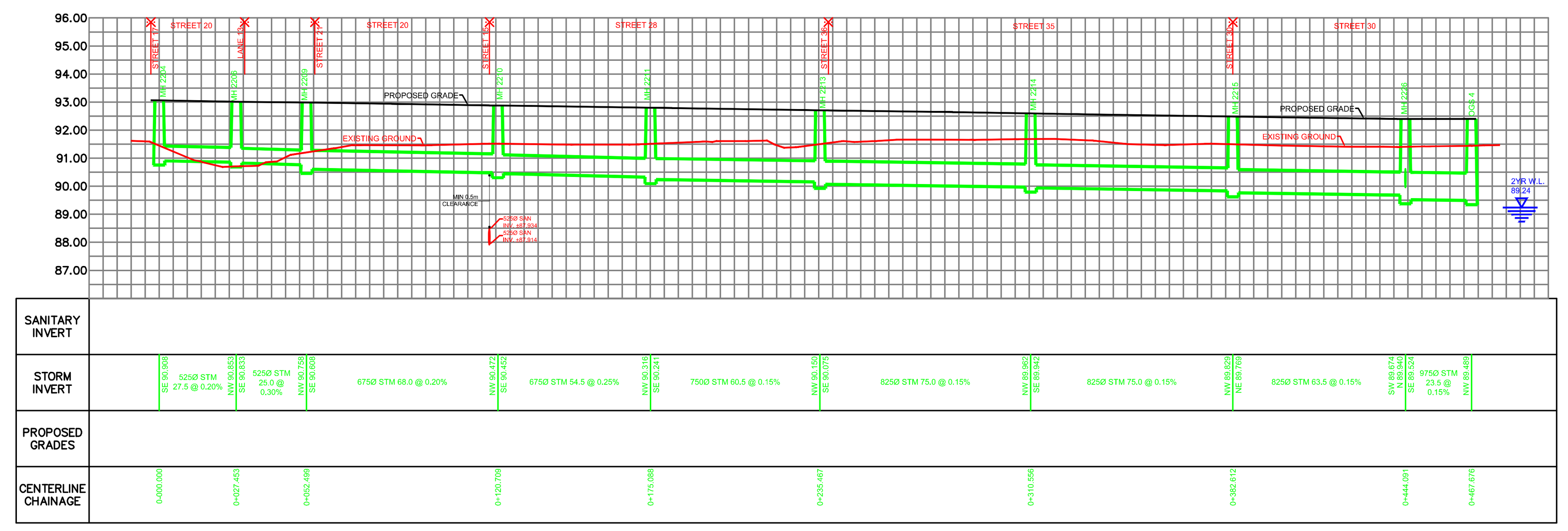
STORM TRUNK 5A



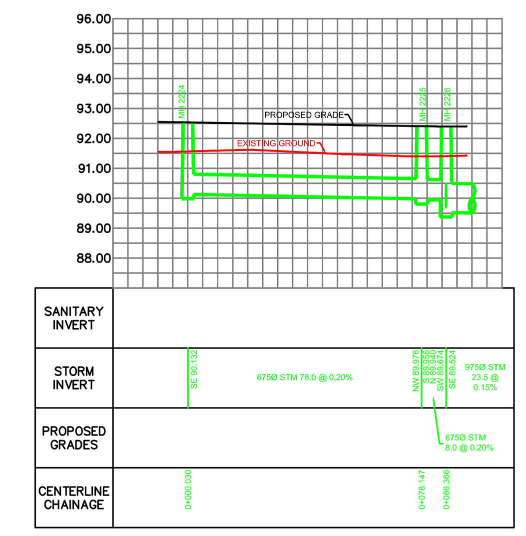
STORM TRUNK 3



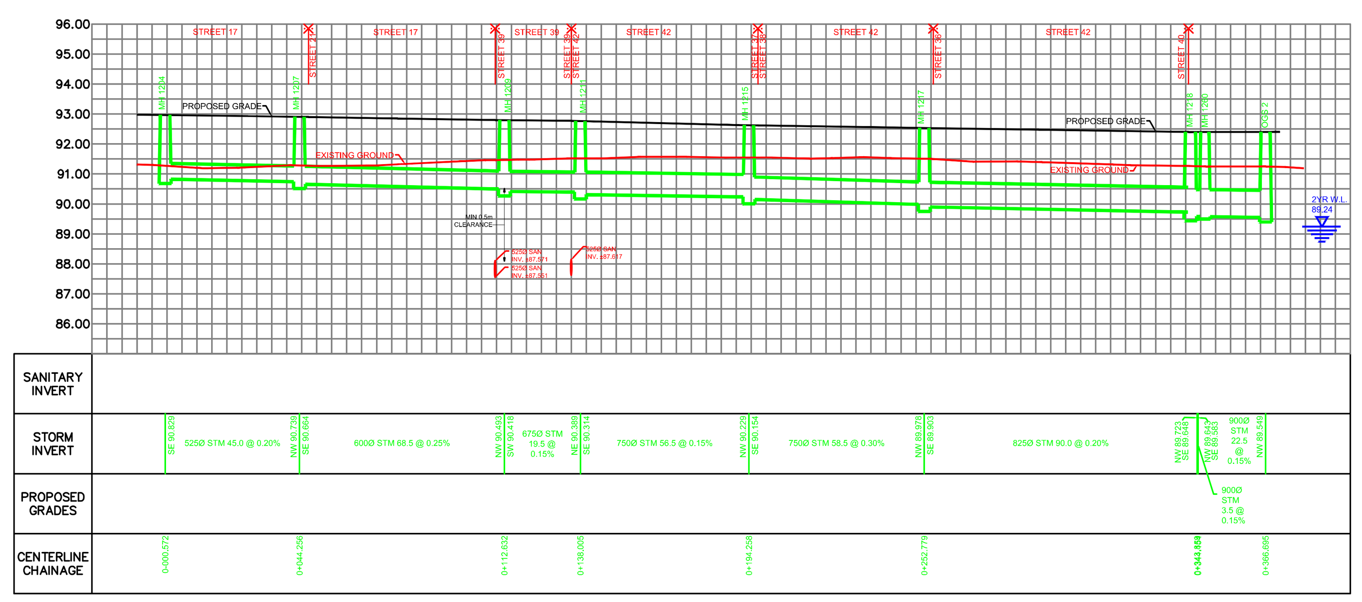
STORM TRUNK 4



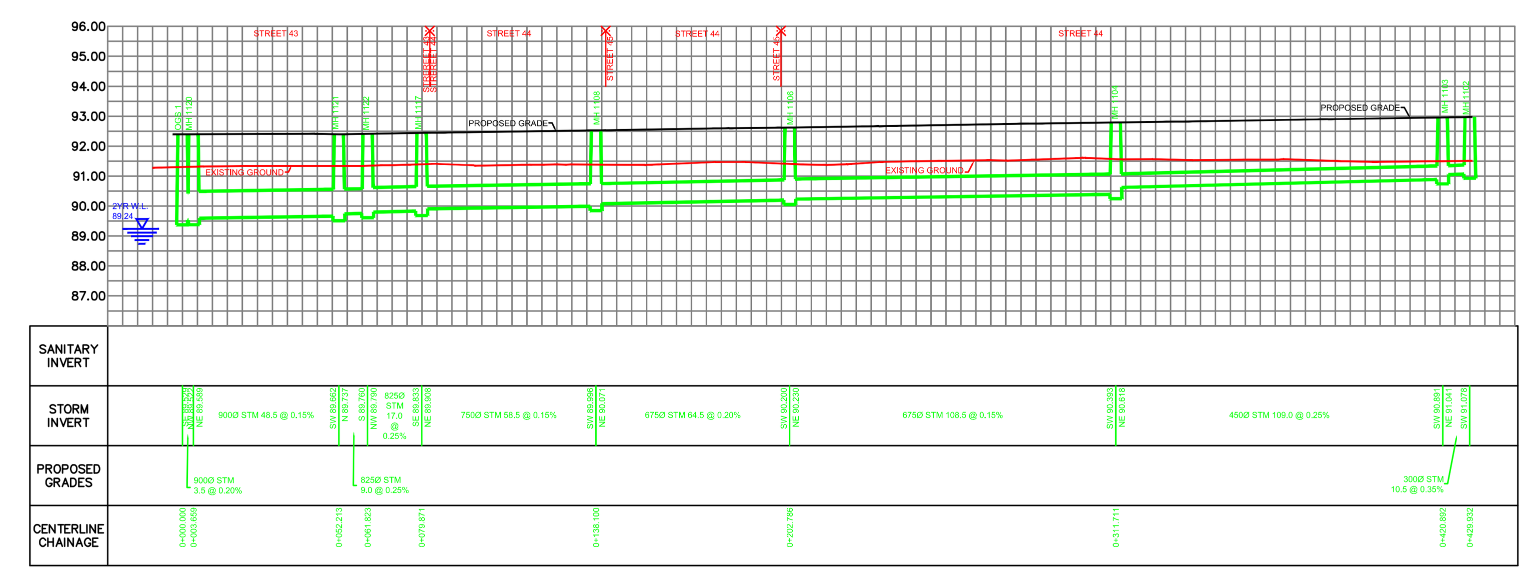
STORM TRUNK 4A



STORM TRUNK 2



STORM TRUNK 1



DSEL
david schaeffer engineering ltd

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Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

BARRHAVEN CONSERVANCY EAST
SANITARY AND STORM TRUNK PROFILES
CITY OF OTTAWA

PROJECT No. :	16-891
SCALE:	1:2000
DATE:	JULY 2020
DRAWING No.	6

APPENDIX A

GENERAL

Content Copy Of Original

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER 8129-AB7LDF
Issue Date: June 23, 2016

City of Ottawa
100 Constellation Cresent West, 6th Floor
Ottawa, Ontario
K2G 6J8

Site Location: Jockvale Road and Strandherd Drive
City of Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act , R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

sanitary sewers to be constructed in the City of Ottawa, on various vacant development lands (from Station 0+003 to Station 2+517), Greenbank Road (from Station 1+846 to Station 1+947), and Jockvale Road (from Station 2+430 to Station 2+517);

all in accordance with the application form from the City of Ottawa, dated June 22, 2016, including final plans and specifications prepared by Novatech Engineers, Planners and Landscape Architects.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary***** Environmental Review Tribunal 655 Bay Street, Suite 1500	AND	The Director appointed for the purposes of Part II.1 of the Environmental Protection Act

Toronto, Ontario
M5G 1E5

Ministry of the Environment and Climate Change
135 St. Clair Avenue West, 1st Floor
Toronto, Ontario
M4V 1P5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 23rd day of June, 2016

Gregory Zimmer, P.Eng.
Director
appointed for the purposes of Part II.1 of the *Environmental Protection Act*

AF/
c: District Manager, MOECC Ottawa
Water Supervisor, MOECC, Ottawa
M. Rick O'Connor, City Clerk, City of Ottawa
Luc Marineau, City of Ottawa
Jonathan Knoyle, City of Ottawa
Bob Dowdall, Novatech Engineers, Planners and Landscape Architects
Edson Donnelly, Novatech Engineers, Planners and Landscape Architects

APPENDIX B

WATER SUPPLY

Stantec

Memo

To:	Hugo Lalonde / Kevin Murphy (DSEL) Barrhaven Conservancy Development Corporation	From:	Jasmin Sidhu / Kevin Alemany Stantec Consulting Ltd.
File:	1634-01437	Date:	February 13, 2020

Reference: Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation

OVERVIEW

Stantec Consulting Ltd. (Stantec) was retained by Barrhaven Conservancy Development Corporation to perform a hydraulic assessment for a land parcel located adjacent to Pressure Zone (PZ) 3SW (previously known as PZ BARR). This technical memo reviews and assesses the limitations/opportunities associated with servicing the parcel in question as it is located near the Jock River. The parcel in question, which is divided into east (Conservancy East) and west (Conservancy West) portions, is herein referred to as the Barrhaven Conservancy Lands.

BACKGROUND REVIEW

As part of the assessment, the following reports were reviewed:

- City of Ottawa 2013 Water Master Plan, Stantec Consulting Ltd., September 2013;
- Kennedy-Burnett Potable Water Master Servicing Study, Stantec Consulting Ltd., April 2014;
- SUC Water Infrastructures Upgrades – Hydraulic Assessment, Stantec Consulting Ltd., July 2015; and,
- Barrhaven Master Servicing Study Addendum – Revised Potable Water and Sanitary Servicing Analysis for the Barrhaven South Urban Expansion Area, Stantec Consulting Ltd., March 2017.

ZONE 3SW AND ZONE SUC

ZONAL WATER DEMANDS & POPULATION PROJECTIONS

Zone 3SW services the lands adjacent to the proposed Barrhaven Conservancy Lands development. In 2015, the City embarked on a large initiative to reconfigure the pressure zones servicing Barrhaven and the southern reaches of Ottawa, and area called the South Urban Community (SUC). The purpose of the zone reconfiguration was to improve reliability, to improve efficiencies and to provide increased pumping capacity for future growth.

Table 1 shows the projected water demands and **Table 2** shows the projected populations of Zone 3SW and Zone SUC before and after the pressure zone reconfiguration. These values were adapted from the City of Ottawa 2013 Water Master Plan (Stantec, 2013) and the SUC Water Infrastructure Upgrades – Hydraulic Assessment (Stantec, 2015) reports.

Reference: **Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation**

Table 1: Water Demand Projections

Zone	Existing Pre-Zone Reconfiguration (MLD)			2018 Post-Zone Reconfiguration (MLD)			2031 Post-Zone Reconfiguration (MLD)			2060 Post-Zone Reconfiguration (MLD)		
	BSDY	MXDY	PKHR	BSDY	MXDY	PKHR	BSDY	MXDY	PKHR	BSDY	MXDY	PKHR
3SW	12.0	26.2	52.3	5.7	11.7	27.0	6.3	12.8	29.5	6.4	12.9	29.8
SUC	3.4	7.3	14.6	24.7	47.6	90.8	44.4	78.7	148.9	63.3	107.6	207.1

Table 2: Population Projections

Zone	Existing Pre-Zone Reconfiguration	2018 Post-Zone Reconfiguration	2031 Post-Zone Reconfiguration	2060 Post-Zone Reconfiguration
3SW	48,917	29,995	30,363	31,183
SUC	5,737	137,909	175,073	234,538

PUMPING CAPACITY

The newly installed pumps for Zone 3SW are sized based on population/demand projections for lands within current approved growth areas. They do not include demands attributed to the Barrhaven Conservancy Lands. As such, the current pumping capacity into Zone 3SW is not sufficient to supply these additional lands along with the growth already planned for in Zone 3SW up to 2060 projections.

The Fallowfield Road Pumping Station (FRPS) (previously known as Barrhaven Reservoir Pumping Station) and Barrhaven Pumping Station (BPS) will continue to service Zone 3SW post pressure zone reconfiguration; however, both pump stations are being equipped with new pumps that were sized for the post pressure zone reconfiguration water demands in Zone 3SW.

The new FRPS is already commissioned and in operation while the BPS is currently undergoing pumping tests on the newly installed pumps as part of its commissioning process.

The BPS is changing from a single zone station to a dual zone pump station and will operate in conjunction with Ottawa South Pumping Station (OSPS) to service the newly expanded Zone SUC. It will also continue to service the smaller/reduced Zone 3SW with one of its pumps.

The Ottawa South Pumping Station is the second pumping station that will feed Zone SUC. It is currently undergoing a detailed design for its upgrade. It may be possible to make some provisions to account for the additional demands in SUC however it is recommended that this be considered as soon as possible through discussions with the City.

Table 3 provides the pumping capacities into each pressure zone post zone reconfiguration upgrades.

Reference: **Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation**

Table 3: Pumping Capacity Post-Zone Reconfiguration

Zone	Firm Pumping Capacity (MLD)	Total Pumping Capacity (MLD)
3SW	14	21
SUC	113	173

Due to the elevated balancing storage provided by Moodie Tank, the firm capacity of the 3SW pumps must be able to supply the future 2060 maximum day demand of 12.9 MLD as shown in **Table 1**. The 3SW pumps were sized based on 2060 demands as they do not increase significantly compared to 2018 post zone reconfiguration demands.

In Zone SUC, without elevated storage, the firm capacity of the pumps must be able to supply the greater demand of peak hour (90.8 MLD) or maximum day plus fire flow (66.3 MLD; FF = 18.7 MLD) for post zone reconfiguration demands. It should be noted that pumping capacity at the SUC pump stations will be further increased in the future to meet 2031 and 2060 projected demands.

The above shows that both the 3SW and SUC pumps have been sized to meet the existing and future demands within the previously established growth areas.

HYDRAULIC ASSESSMENT

WATER DEMANDS

Following the 2013 Water Master Plan “Design Criteria and Levels of Service”, when projected population exceeds 3,000 persons, basic unit demands for Zone/System Levels are to be used. For residential land-uses, single family and semi-detached homes were considered to have similar demands, with both types of residential home categorized under “single family home” or SFH. All townhomes were categorized under “multi-level townhomes” or MLT and all apartments or high-density units were categorized under APT. Consumption rates for SFH, MLT and APT are presented in **Table 4**.

To determine the MXDY demand, an outdoor water demand (OWD) of 1,049 L/SFH/d is allocated to all SFH units. This is a fixed value and does not change with zone demand. This outdoor water demand is added to the basic day (BSDY) demand to obtain the MXDY demand.

The unit counts were provided by David Schaeffer Engineering Ltd. (DSEL) via email on January 21, 2020. The estimated water demands are presented in **Table 4**. This additional demand is not within the current capacity of the new pumps within Zone 3SW.

Reference: Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation

Table 4: Estimated Water Demands of the Barrhaven Conservancy Lands

Unit Types	Unit Count			PPU	Persons	L/c/d	BSDY (MLD)	MXDY (MLD)
	Conservancy East	Conservancy West	Total					
Single Family	725	775	1,500	3.4	5,100	180	0.92	2.49
Townhouse	475	525	1,000	2.7	2,700	198	0.53	0.53
Rear-Lane Townhouse	250	-	250	2.7	675	198	0.13	0.13
High Density	50	-	50	2.1	105	219	0.02	0.02
Total	***1,500***	***1,300***	***2,800***		***8,580***		***1.60***	***3.18***

POTABLE WATER SERVICING ALTERNATIVES

Figures 1 to **5** and **Table 5** present alternatives to service the Barrhaven Conservancy Lands with potable water and discusses limitations of each alternative. It should be noted that the alignments shown in **Figures 1** to **5** are approximate with the intent to show general locations for possible connections.

All alternatives are anticipated to satisfy the City's objective minimum pressure of 40 psi during peak hour demand and achieve a typical planning level fire flow value 10,000 L/min or greater.

Alternative 1 – Servicing from 3SW

Figure 1 shows the connection points to the Kennedy-Burnett watermains that are fed by the future Strandherd Drive watermain.

Based the Kennedy-Burnett Potable Water Master Servicing Study (Stantec, 2014), which is a subdivision adjacent to the Barrhaven Conservancy Lands, it is likely the Barrhaven Conservancy Lands will experience pressures greater than the City of Ottawa's objective pressure of 80 psi during basic day demands if operating at Zone 3SW pressure. Pressure mitigation measures would need to be considered (i.e. pressure reducing valves (PRVs) at individual service connections).

Pumping capacity upgrades at FRPS and/or BPS would be required to service the Barrhaven Conservancy Lands from Zone 3SW on a permanent basis. As an example of costs, recent upgrades to the FRPS totaled approximately $1.5 million. Additional works at FRPS and BPS to service the Conservancy Lands could include retrofitting the pump(s), piping, valving and supporting infrastructures as well as instrumentation, electrical and mechanical aspects. A more in-depth assessment would be required to determine the potential costs.

Another alternative to service the Barrhaven Conservancy Lands from Zone 3SW would be on a temporary basis. As shown in **Figure 1**, the initial phase of development (estimated boundary shown) could be serviced at 3SW pressure and switched over to SUC pressure at a later time as development takes place. While this alternative is likely to be technically feasible, the extent of development within the Barrhaven Conservancy Lands that can operate at 3SW pressure in the interim will depend on the City's planning and approvals currently in place. This alternative essentially borrows capacity from existing approved areas within Zone 3SW until such time that the borrowed capacity is replaced through system upgrades. Through informal discussions between DSEL and City staff, the City has indicated that this is not a desirable option.

Reference: Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation

Alternative 2 – Servicing from SUC

Figures 2, **3** and **4** show the Barrhaven Conservancy Lands being serviced by new SUC watermains and include two options for a secondary feed.

Based on findings from the Barrhaven South Urban Expansion Area Master Servicing Study (Stantec, 2017), the Barrhaven Conservancy Lands can anticipate maximum pressures greater than 75 psi and potentially be greater than 80 psi during basic day demands if operating at Zone SUC pressure. If they were to exceed 80 psi, PRVs would need to be considered.

A new SUC watermain running parallel to the Strandherd watermain, as proposed as the primary feed for Alternatives 2a and 2b, could connect to the Kennedy-Burnett (KB) watermains and this may require the KB subdivision to operate at SUC pressures. Alternative 2a proposes a secondary feed from Nepean Town Centre (NTC). Alternative 2b proposes a secondary feed from Barrhaven South. Both options present their own unique challenges with either limited land access or crossings of bodies of water.

Alternative 2c proposes both primary and secondary feeds from the NTC (one along future Chapman Mills Drive and one through the future Claridge development from southeast of the KB pond) to service the first stages of development in the Conservancy Lands. The Kennedy-Burnett Potable Water Master Servicing Study (Stantec, 2014) looked at servicing this area from the NTC in the future SUC pressure zone. Based on findings of this study, servicing the Conservancy Lands with two 300 mm diameter watermains from the NTC is possible, however ultimate optimization of sizing would have to be completed at a later phase. Similar to Alternatives 2a and 2b, this option presents challenges due to limited land access or crossings of a body of water.

Alternative 3 – Servicing from SUC with an Automated Valve from 3SW

Figure 5 shows the Barrhaven Conservancy Lands being serviced by a new SUC watermain running parallel to the Strandherd Drive watermain and a secondary feed from 3SW for emergency conditions.

This alternative proposes a secondary feed from 3SW via an automated valve off the future Strandherd Drive watermain. Water would flow from the high pressure Zone 3SW into the low pressure Zone SUC if there is a pressure drop on the SUC side of the valve. This alternative requires an interzonal valve connection that is not typically used/accepted in the City of Ottawa and would present both operational challenges and costs to operate and maintain.

Table 5: Potable Water Servicing Alternatives & Limitations

Alternative		Zone	Max Pressures	Min Pressures	Available Fire Flow at 20 psi	Limitations
1	Connect to the future 3SW 406 mm dia. WM along Strandherd Drive at two locations	3SW	> 80 psi	> 40 psi (ok)	> 10,000 L/min	Requires additional pumping capacity in Zone 3SW. Will require individual pressure reducing valves (PRVs) at each service connection.
2a	Connect to a future SUC WM that will run parallel to the future Strandherd WM and connect to a 2nd future SUC WM from the NTC	SUC	> 75 psi; could potentially be > 80 psi	> 40 psi (ok)	> 10,000 L/min	Requires crossing water way east of the Barrhaven Conservancy Lands. Land around ponds may not be accessible.

Reference: **Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation**

Alternative		Zone	Max Pressures	Min Pressures	Available Fire Flow at 20 psi	Limitations
	(north of the Jock River)					Potentially requires operating Kennedy-Burnett Lands at SUC pressure. Likely requires PRVs at each service connection.
2b	Connect to a future SUC WM that will run parallel to the future Strandherd WM and connect to a 2nd future SUC WM from Barrhaven South (south of the Jock River – crossing river)	SUC	> 75 psi; could potentially be > 80 psi	> 40 psi (ok)	> 10,000 L/min	Requires crossing the Jock River. Potentially requires operating Kennedy-Burnett Lands at SUC pressure. Likely requires PRVs at each service connection.
2c	Connect to future SUC WMs in the NTC (north of the Jock River) at two locations	SUC	> 75 psi; could potentially be > 80 psi	> 40 psi (ok)	> 10,000 L/min	Requires crossing water way at one location east of the Barrhaven Conservancy Lands. Land around ponds may not be accessible. Potentially requires operating Kennedy-Burnett Lands at SUC pressure. Likely requires PRVs at each service connection.
3	Connect to a future SUC WM that will run parallel to the future Strandherd WM and connect to the Strandherd 3SW WM using an automated valve to feed from 3SW under emergency conditions	SUC	> 75 psi; Could potentially be > 80 psi	> 40 psi (ok)	> 10,000 L/min	Requires crossing water way east of the Barrhaven Conservancy Lands. Land around ponds may not be accessible. Requires operating Kennedy-Burnett Lands at SUC pressure. May possibly require PRVs at each service connection. An automated 3SW/SUC valve presents operational challenges and costs.

SUMMARY & RECOMMENDATIONS

The recent pump station upgrades at the Zone 3SW pump stations are nearing completion. Alternative 1 for servicing the Conservancy Lands would eventually require changing the recently commissioned pumps at the Fallowfield Road Pumping and Station and one of the new pumps at the Barrhaven Pump Station and potentially some of the associated piping, valving, instrumentation, electrical and mechanical appurtenances for higher capacity pumps and appurtenances. Due to the anticipated maximum pressures exceeding 80 psi during basic day demands, individual PRVs will be required at each service connection if the lands operate at Zone 3SW

Reference: Hydraulic Potable Water Assessment for Barrhaven Conservancy Development Corporation

pressure. It is understood from informal discussions between DSEL and City staff that this is not a desirable option.

Servicing the Conservancy Lands from Zone SUC requires either a crossing of a stormwater pond and/or the Jock River to complete a looping network. All three alternatives present their own challenges with either limited land access or crossing of bodies of water. City staff have indicated through informal discussions with DSEL a preference for Alternative 2c. Based on findings of the Kennedy-Burnett Potable Water Master Servicing Study, servicing the Conservancy Lands with two 300 mm diameter watermains from the NTC is possible, however ultimate optimization of sizing would have to be completed at a later phase.

An automated 3SW/SUC valve could potentially be considered for interim conditions, as discussed in Alternative 3, however inter-zonal automated valve connections are not typically used/accepted in the City of Ottawa and would present both operational challenges and costs to operate and maintain.

Sincerely,

Stantec Consulting Ltd.

Jasmin Sidhu P. Eng.
Water Resources Engineer

Phone: 613 725 5553
Fax: 613 722 2799
Jasmin.Sidhu@stantec.com

Kevin Alemany M.A.Sc., P. Eng.
Principal, Water

Phone: 613 724 4091
Fax: 613 722 2799
Kevin.Alemany@stantec.com

Attachment:
Figure 1: Alternative 1 – Servicing from Zone 3SW
Figure 2: Alternative 2a – Servicing from Zone SUC (from Strandherd) w/ Secondary Feed from NTC
Figure 3: Alternative 2b – Servicing from Zone SUC (from Strandherd) w/ Secondary Feed from Barrhaven South
Figure 4: Alternative 2c – Servicing from Zone SUC (from NTC) w/ Secondary Feed from NTC
Figure 5: Alternative 3 – Servicing from Zone SUC w/ Automated Valve from 3SW for Emergency Conditions

Figure 1: Alternative 1 - Servicing from Zone 3SW

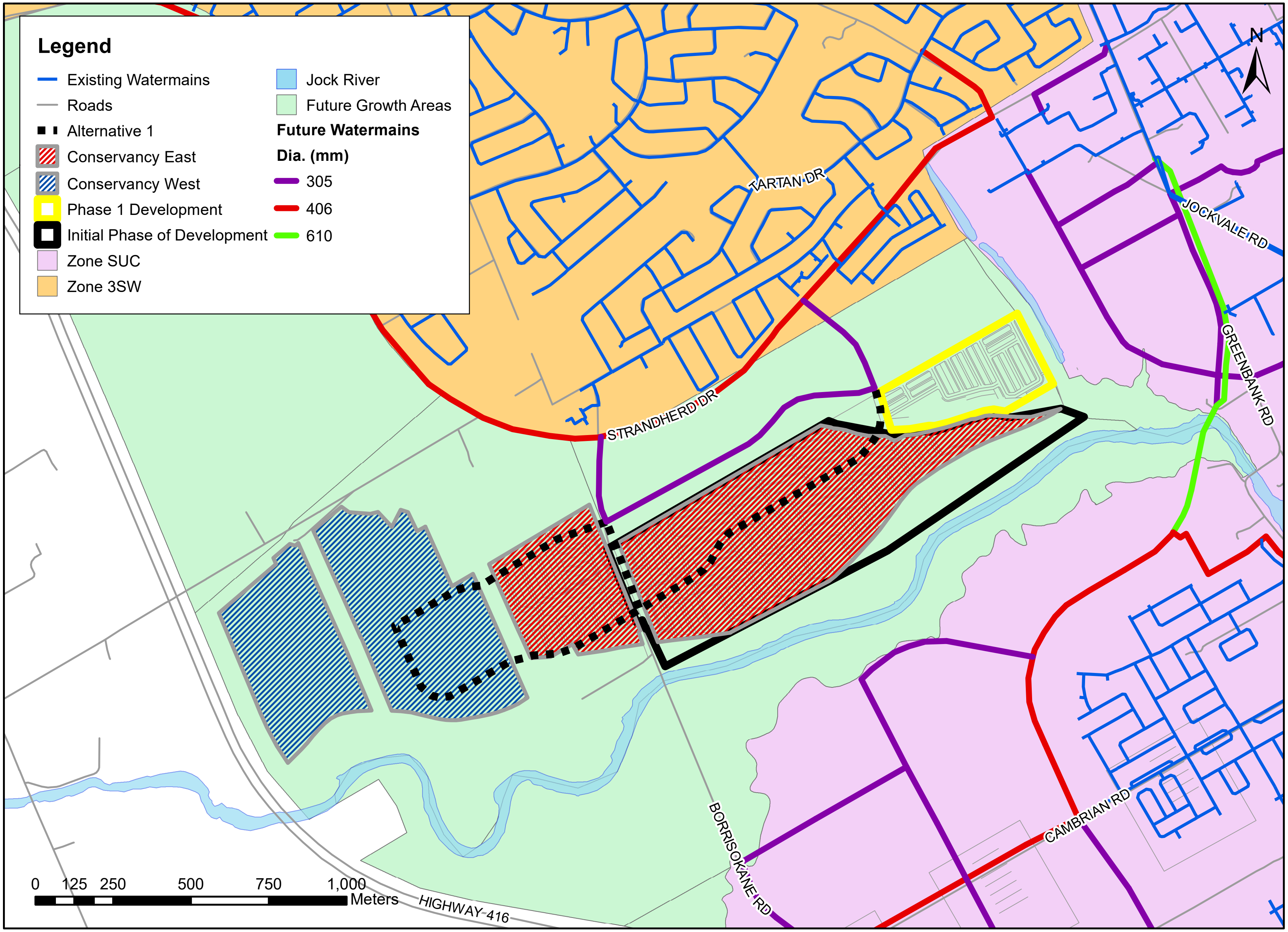


Figure 2: Alternative 2a - Servicing from Zone SUC (from Strandherd) w/ Secondary Feed from NTC

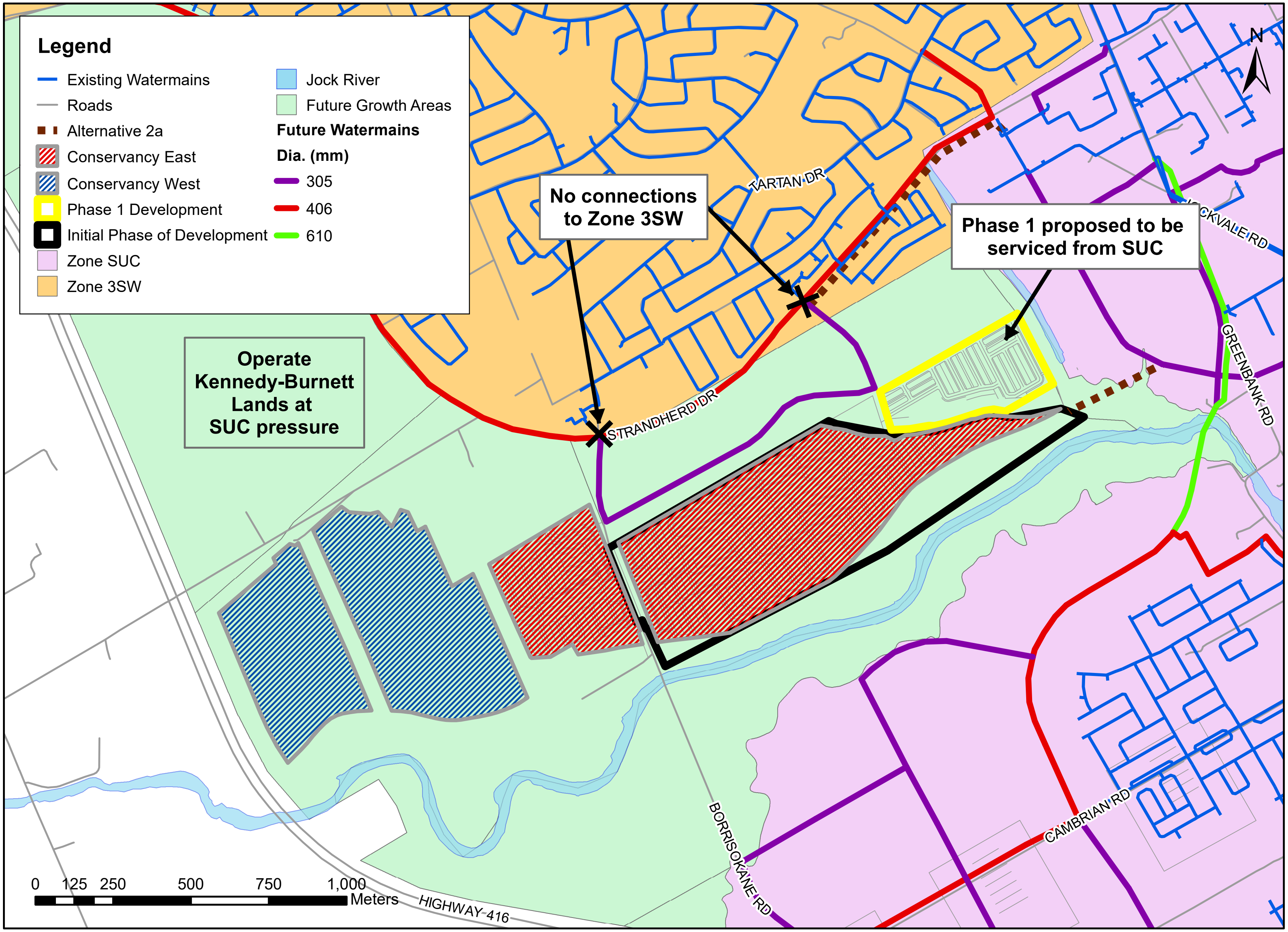


Figure 3: Alternative 2b - Servicing from Zone SUC (from Strandherd) w/ Secondary Feed from Barrhaven South

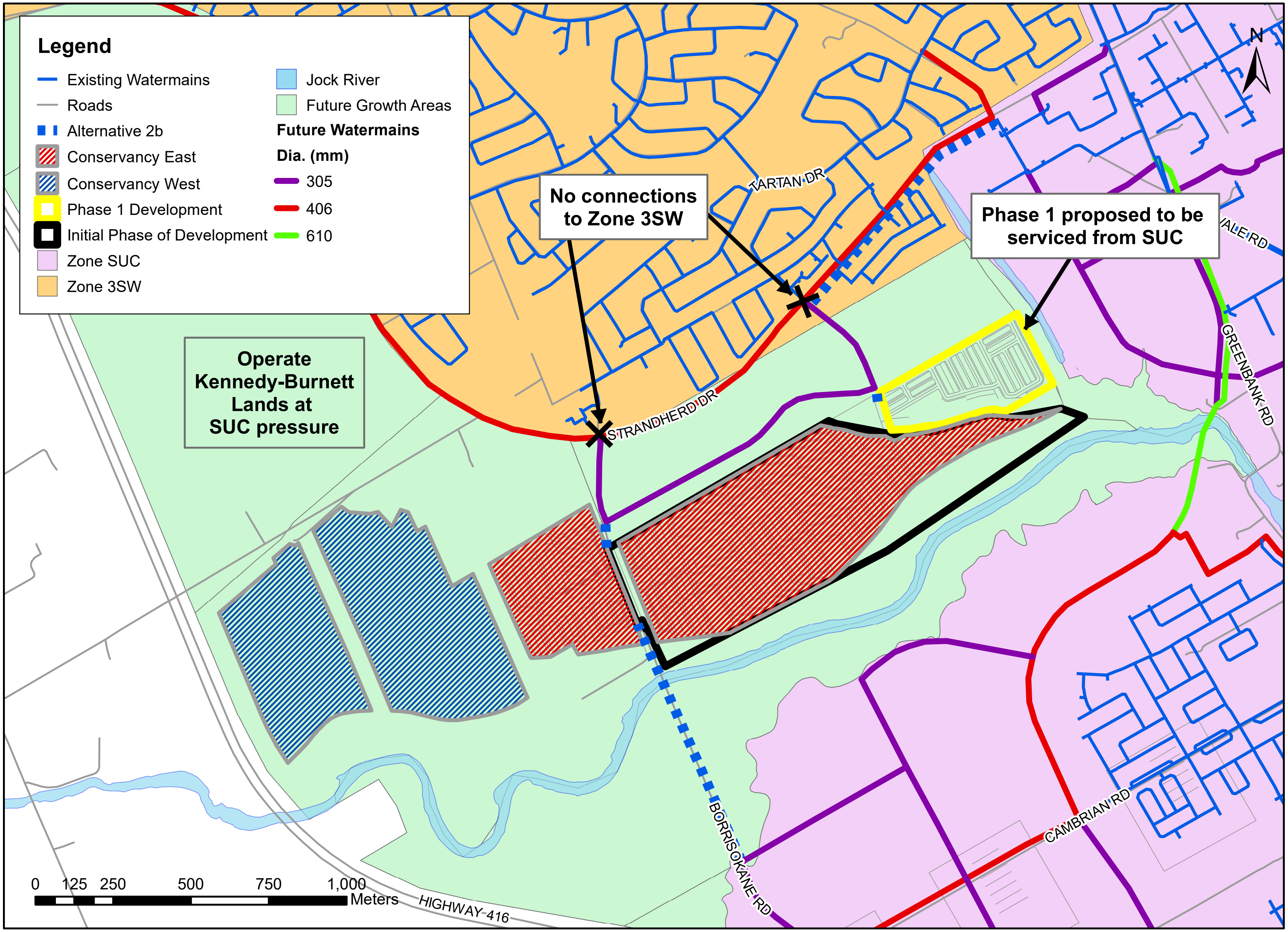


Figure 4: Alternative 2c - Servicing from Zone SUC (from NTC) w/ Secondary Feed from NTC

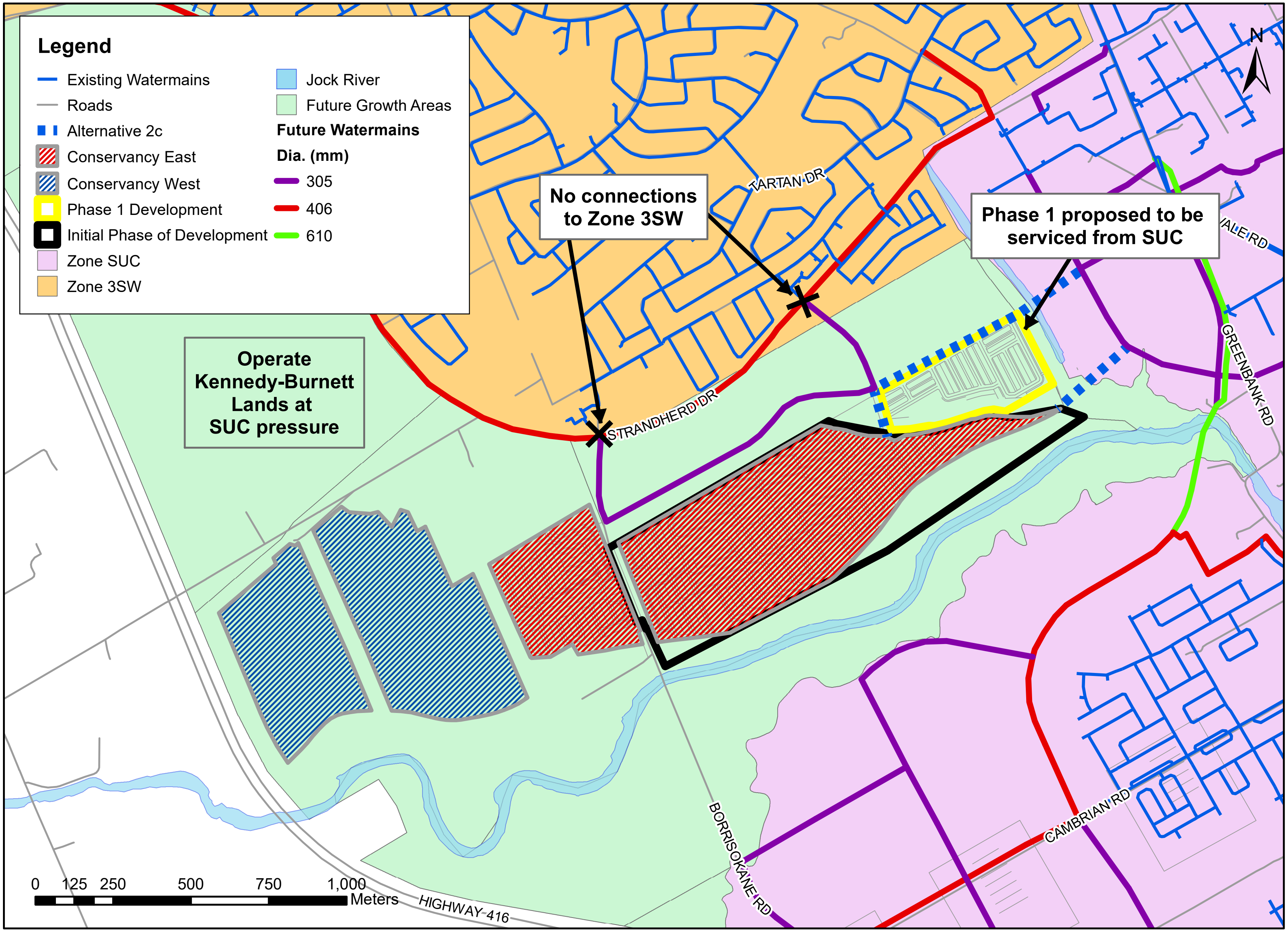
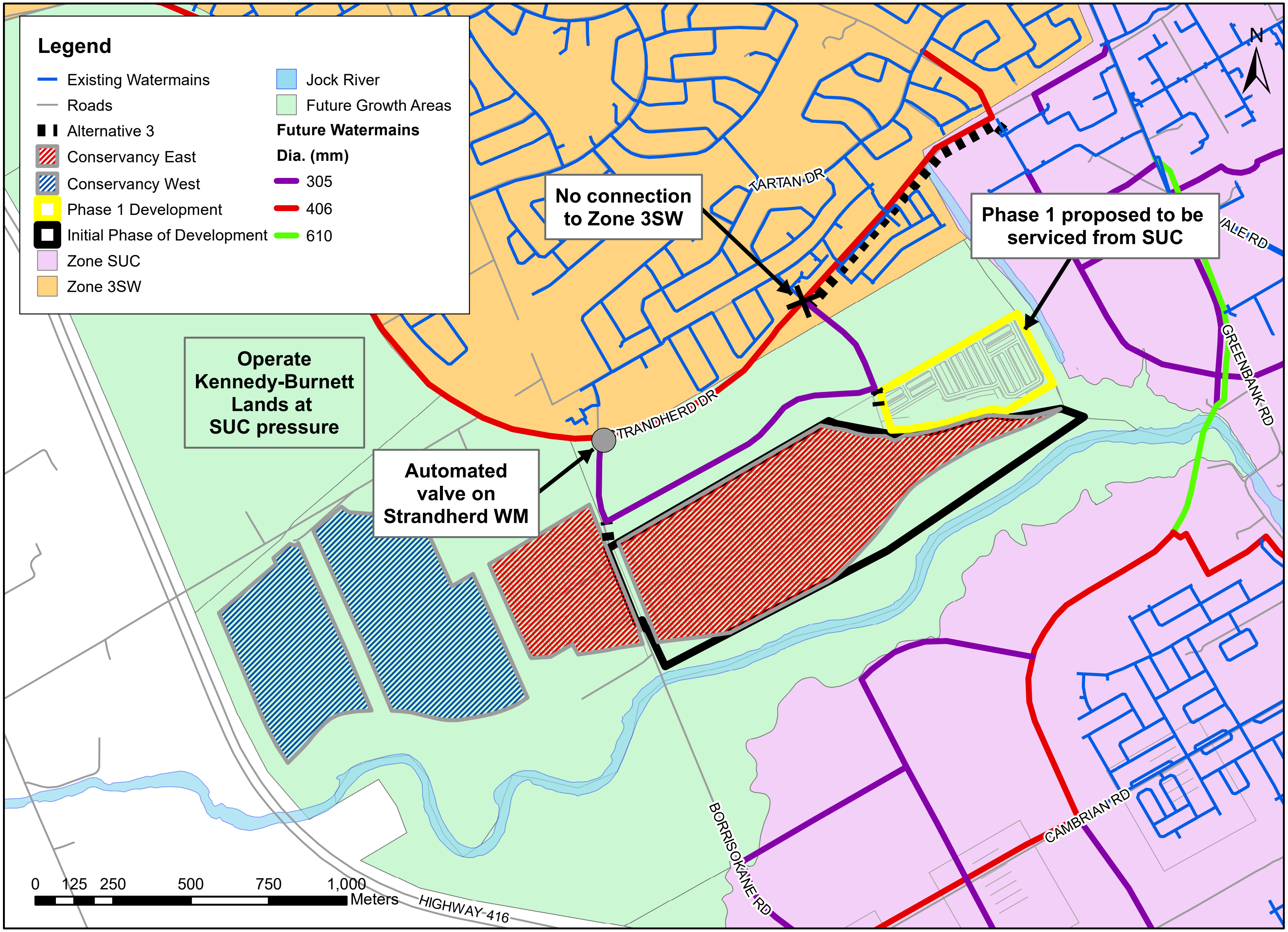


Figure 5: Alternative 3 - Servicing from Zone SUC w/ Automated Valve from 3SW for Emergency Conditions



Kennedy-Burnett Potable Water Master Servicing Study

Prepared for:
City of Ottawa
100 Constellation Crescent
Ottawa, ON K2G 6G8

Prepared by:
Stantec Consulting Ltd.
400-1331 Clyde Avenue
Ottawa, ON K2C 3G4

File No. 1634-01221

April 29, 2014

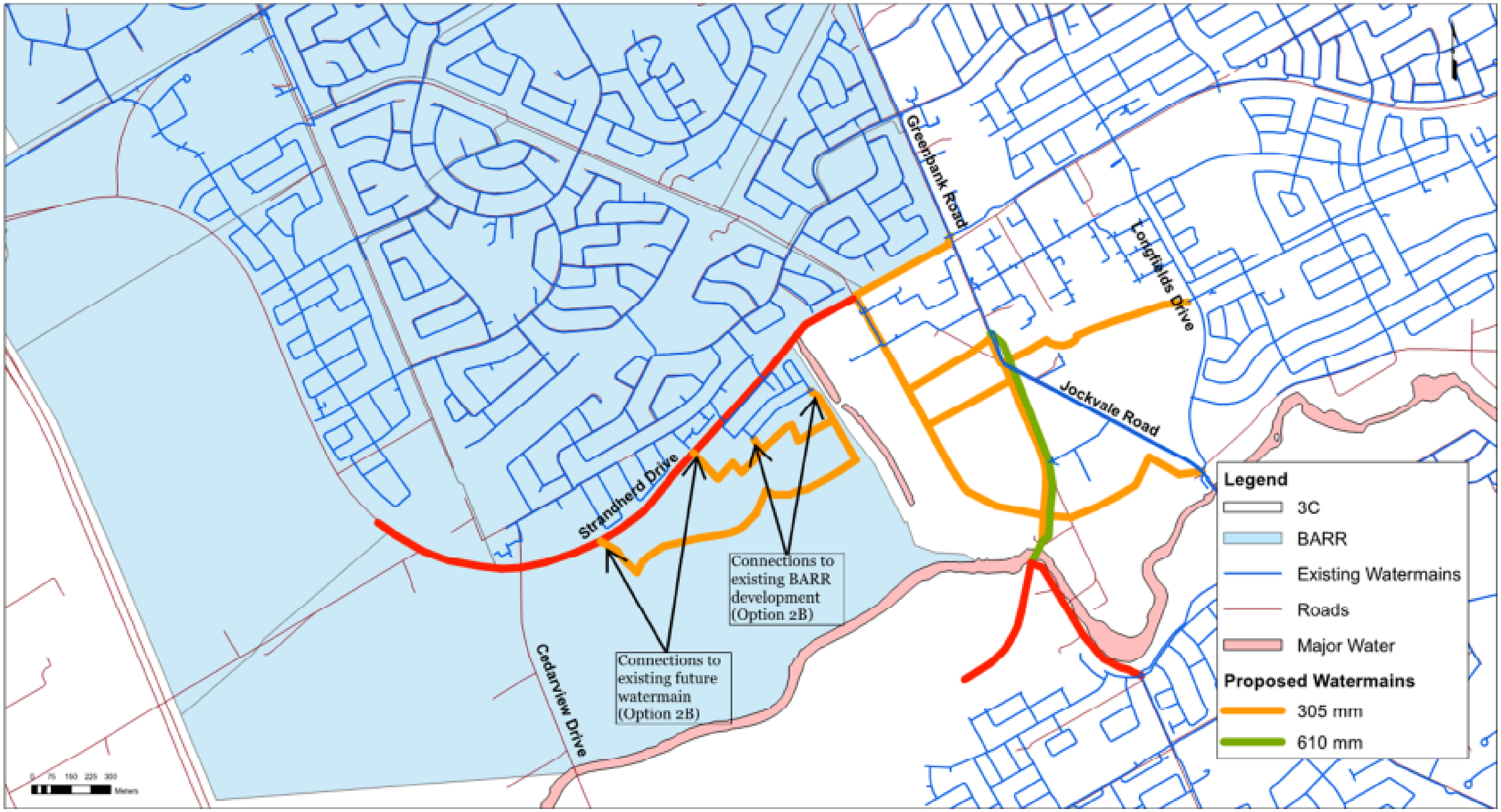
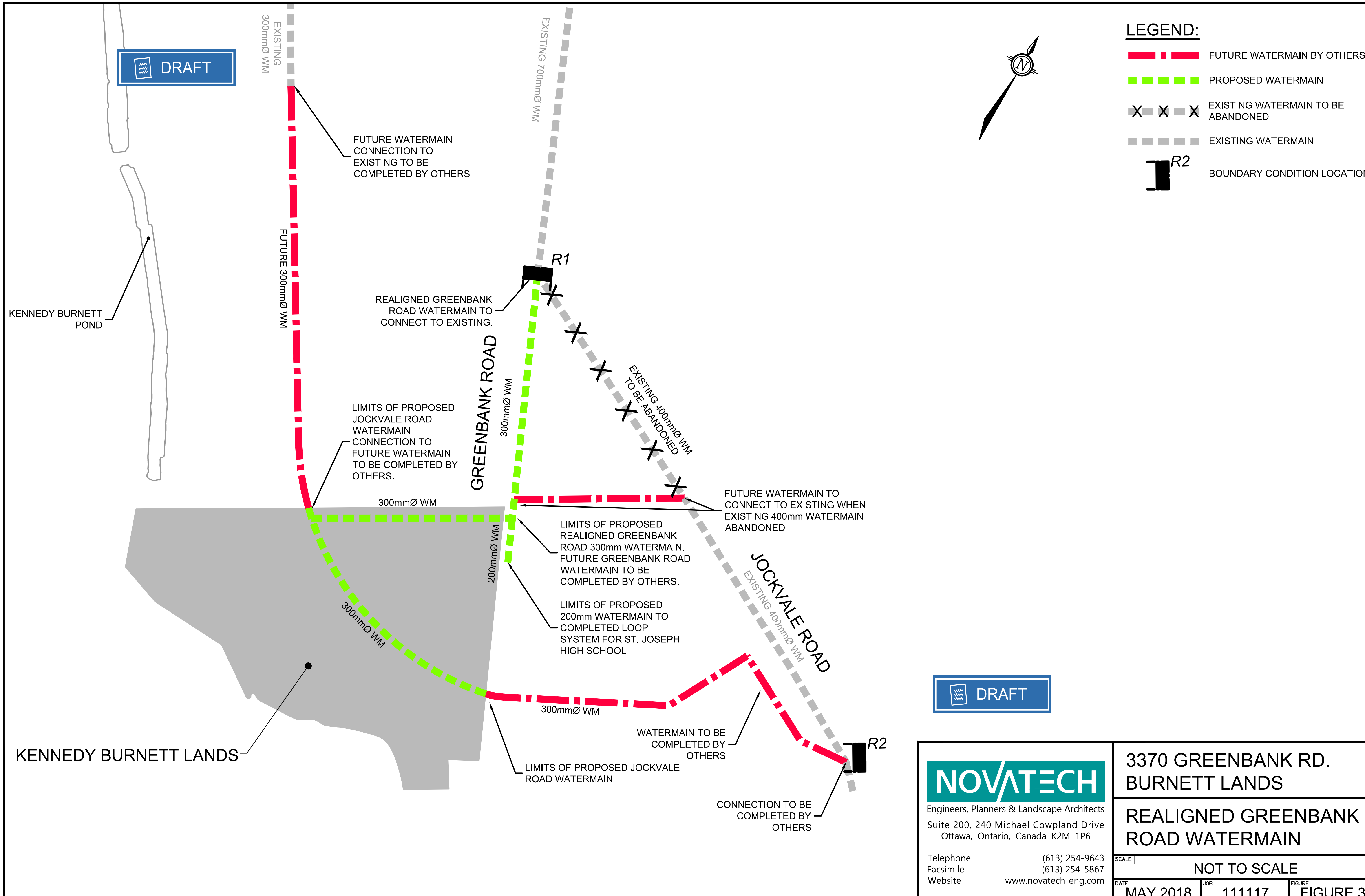


Figure 2-6: Proposed Pipe Layout Post Zone Reconfiguration – Scenario 2B



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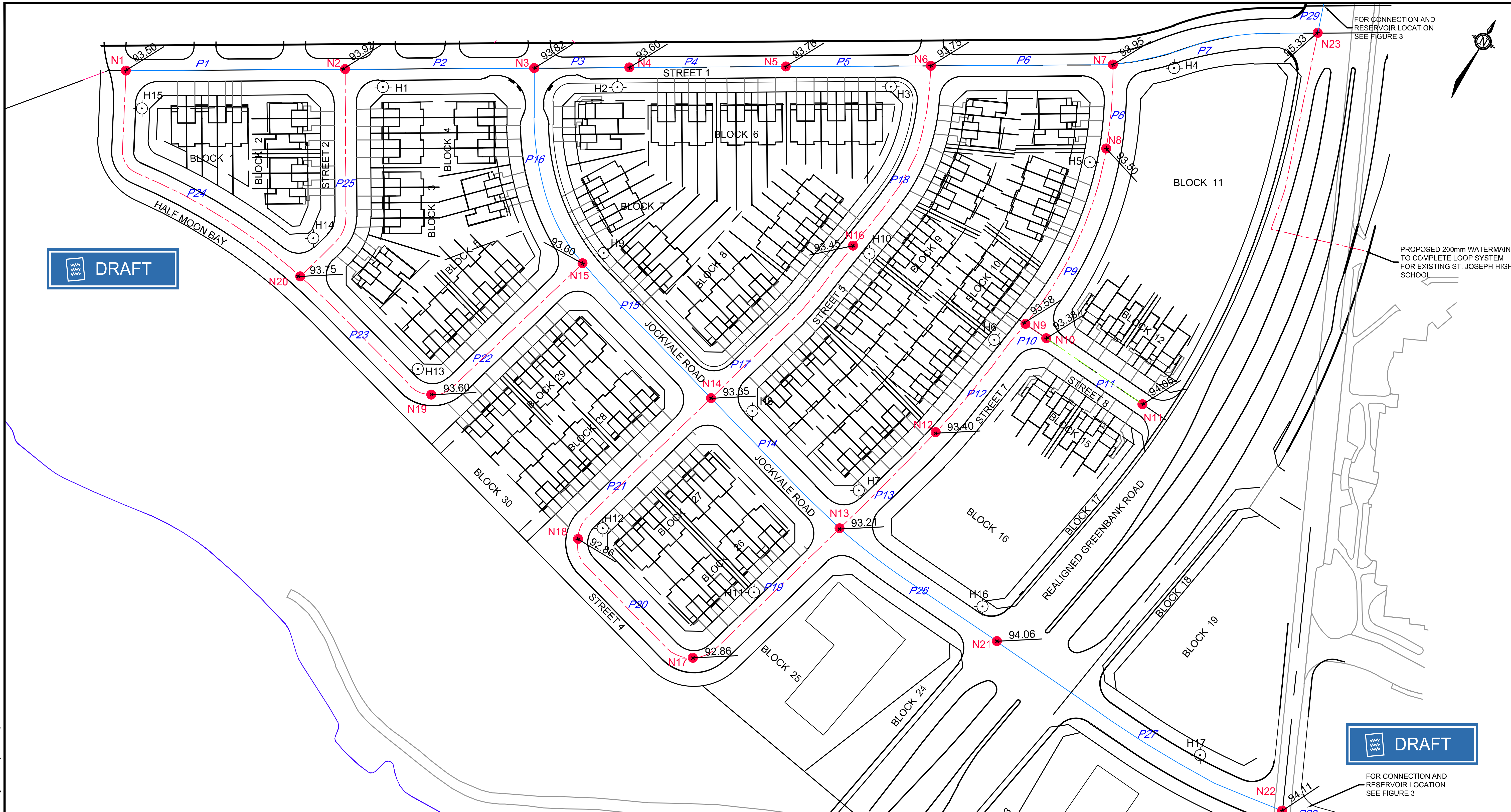

LEGEND

12	PROPOSED 50mmØ WATERMAIN PIPE
12	PROPOSED 200mmØ WATERMAIN PIPE
4	PROPOSED 300mmØ WATERMAIN PIPE
4	WATERMAIN NODE
	RESERVOIR
	HYDRANT
97.75	GROUND ELEVATION

FIREFLOWS CAN'T BE CAPPED

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

3370 GREENBANK RD. BURNETT LANDS

WATERMAIN LAYOUT

SCALE 1:1500 (0, 15m, 30m, 60m)

DATE MAY 2018 | JOB 111117 | FIGURE FIGURE 4

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APPENDIX C

SANITARY

M E M O R A N D U M

DATE: MAY 30, 2019

TO: JOSÉE VALLEE – CITY OF OTTAWA

FROM: CONRAD STANG – NOVATECH

RE: STRANDHERD DRIVE WIDENING PROJECT
SOUTH NEPEAN COLLECTOR PHASE 3: SANITARY FLOW CALCULATIONS

CC: EDSON DONNELLY – NOVATECH

1.0 PURPOSE

This memorandum provides the sanitary sewer flow calculations and design sheet for Phase 3 of the proposed South Nepean Collector (SNC), as part of the Strandherd Drive Widening Project. Sanitary design flows have been estimated for both current-day operational flows and future development peak design flows. They are based on the latest available planning information for the vacant lands within the SNC sewershed.

2.0 BACKGROUND

In January 1998, the Master Servicing Study for the South Nepean Urban Area provided a conceptual plan for water, wastewater and stormwater infrastructure. The preferred alternative for wastewater servicing was an east/west trunk sewer alignment that was to be completed in several phases. The proposed sanitary trunk sewer was initially called the Jock River Collector, but was renamed the South Nepean Collector during the original functional design study completed in 2003.

Phase 1 of the South Nepean Collector was completed in 2005 and currently terminates at a 2400mm maintenance hole located east of Longfields Drive, north of Bren-Maur Road. Phase 2 was completed in 2016 and currently terminates at a 2400mm maintenance hole located at the intersection of Strandherd Drive and Fraser Fields Way.

Phase 3 will extend the trunk sewer along Strandherd Drive to the intersection of Kennevale Drive. Here it will connect with the existing sanitary trunk sewer that was constructed as part of the 2014 works to improve Strandherd Drive and develop the CitiGate Lands.

The sanitary sewer flows were previously documented in the *South Nepean Collector – Functional Design Report and Update* (Dillon, 2012). Novatech (2016) completed a Hydraulics Review / Assessment of the sanitary flows presented in the Dillion Report (attached). This was based on the latest planning information for the vacant lands within the SNC sewershed. The results of the Hydraulics Review / Assessment (Novatech, 2016) were similar to the results from the Dillion (2012) analysis.

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

3.0 DESIGN PARAMETERS AND POPULATION ESTIMATES

3.1 Design Parameters

The sanitary design flow were calculated using the parameters from the City of Ottawa Sewer Design Guidelines (October 2012), revised per Technical Bulletin ISTB-2018-01 (March 2018). These parameters are summarized in **Table 1** and **Table 2**.

Table 1: Peak Design Flow Parameters

Land Use	Average Daily Flow	Peaking Factor	Peak Extraneous Flows
Residential	280 L/cap/day	Harmon Equation, K=0.8 (1.6 min – 3.2 max)	0.33 L/s/ha
Commercial	28,000 L/ha/day	1.0 – 1.5*	
Institutional	28,000 L/ha/day	1.0 – 1.5*	
Other†	0 L/ha/day	N/A	

**Peak Factor = 1.5 if contributing area is >20%; Peak Factor = 1.0 if contributing area is <20%*
†Open Space, Arterial ROW, SWM Blocks, etc. with no sanitary flow contribution (extraneous flow only)

Table 2: Operational Design Flow Parameters

Land Use	Average Daily Flow	Peaking Factor	Peak Extraneous Flows
Residential	200 L/cap/day	Harmon Equation, K=0.6 (1.2 min – 2.4 max)	0.30 L/s/ha
Commercial	17,000 L/ha/day	1.0 (non-coincident peak)	
Institutional	17,000 L/ha/day	1.0 (non-coincident peak)	

**There are no industrial areas identified within the tributary area.*

Harmon Equation $= 1 + \frac{14}{4+\left(\frac{P}{1000}\right)^{\frac{1}{2}}} \times K$

Where:

P = Population
K = Correction Factor:
- Peak Flow = 0.8
- Operational = 0.6

3.2 Land Use Designations & Population Estimates

Population densities and unit counts for future residential development are based on the Novatech (2016) Hydraulics Review / Assessment; refer to **Table 3**. They are based on the concept plans provided by the developers of the future residential areas.

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Table 3: Residential Land Use Population Densities

Residential Land Use	Units per ha	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

The land use designations shown in **Table 4** have been applied for the areas within Phases 2 & 3 of the SNC (Node 70 to 130). The Hydraulics Analysis / Review delineated the sewershed areas and land use designations using aerial photos (existing development) and conceptual site plans (future development).

Table 4: Land Use Designations

Land Use Designation	
Secondary Plan	**SNC Design**
Residential	Residential (Low / Medium / High Density)
Institutional / Office	Institutional
Commercial	Commercial
Recreational	
Business Park	
Prestige Business Park	
Park/Open Space Area	Other*
Ex. Snow Disposal Facility (future commercial)	
Stormwater Management Facility	
Conservation Lands	
Arterial Right-of-Ways	

** No sanitary flow contribution - extraneous flows (inflow/infiltration) only.*

The overall residential population estimate and sewershed area for Phases 2 and 3 of the SNC is provided in **Table 5** below. It is assumed that the snow dump facility at the Stranderd Drive and McKenna Casey Drive will ultimately be re-zoned for commercial development.

Table 5: Population Estimates and Areas

Existing / Future	Estimated Population / Area	Novatech (2015)
Existing	Estimated Population	6,944 persons
	Gross Residential Area	60.09 ha
	Gross Commercial / Institutional Area	64.37 ha
	Total Sewershed Area	124.5 ha
Future (full service)	Estimated Population	27,312 persons
	Gross Residential Area	248.48 ha
	Gross Commercial / Institutional Area	228.82 ha
	Total Sewershed Area	477.3 ha

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4.0 SANITARY DESIGN FLOWS

The sanitary flow allocations for Phases 2 and 3 of the SNC are provided in **Table 6**. The corresponding sanitary drainage area plan is provided as **Figure 1**. Sanitary sewer flow calculations for Phases 2 and 3 and detailed sanitary sewer design sheets for Phase 3 are attached to this memorandum.

The estimated sanitary design flows from Phase 3 of the SNC (entering Node 90) are as follows:

- Present-Day Operational Design Flows (Theoretical) = 55.1 L/s
- Future Peak Design Flows = 282.5 L/s

The outlet for Phase 3 of the SNC is the existing 900mm outlet pipe at the 2400mm maintenance hole (Node 90) located at the intersection of Strandherd Drive and Fraser Fields Way. Given a minimum design slope of 0.10%, this 900mm sanitary trunk sewer would have a full flow capacity of 597.2 L/s. Therefore, the downstream sanitary trunk sewer would be at 64% capacity, based on the future peak design flow being 282.5 L/s.

ATTACHMENTS:

- Figure 1: Sanitary Drainage Areas and Land Use
- Sanitary Sewer Flow Calculations
- Sanitary Sewer Design Sheets (Phase 3)
- South Nepean Collector Phase 2: Hydraulics Review / Assessment (Novatech, 2016)
- Excerpts from Dillion (2012)

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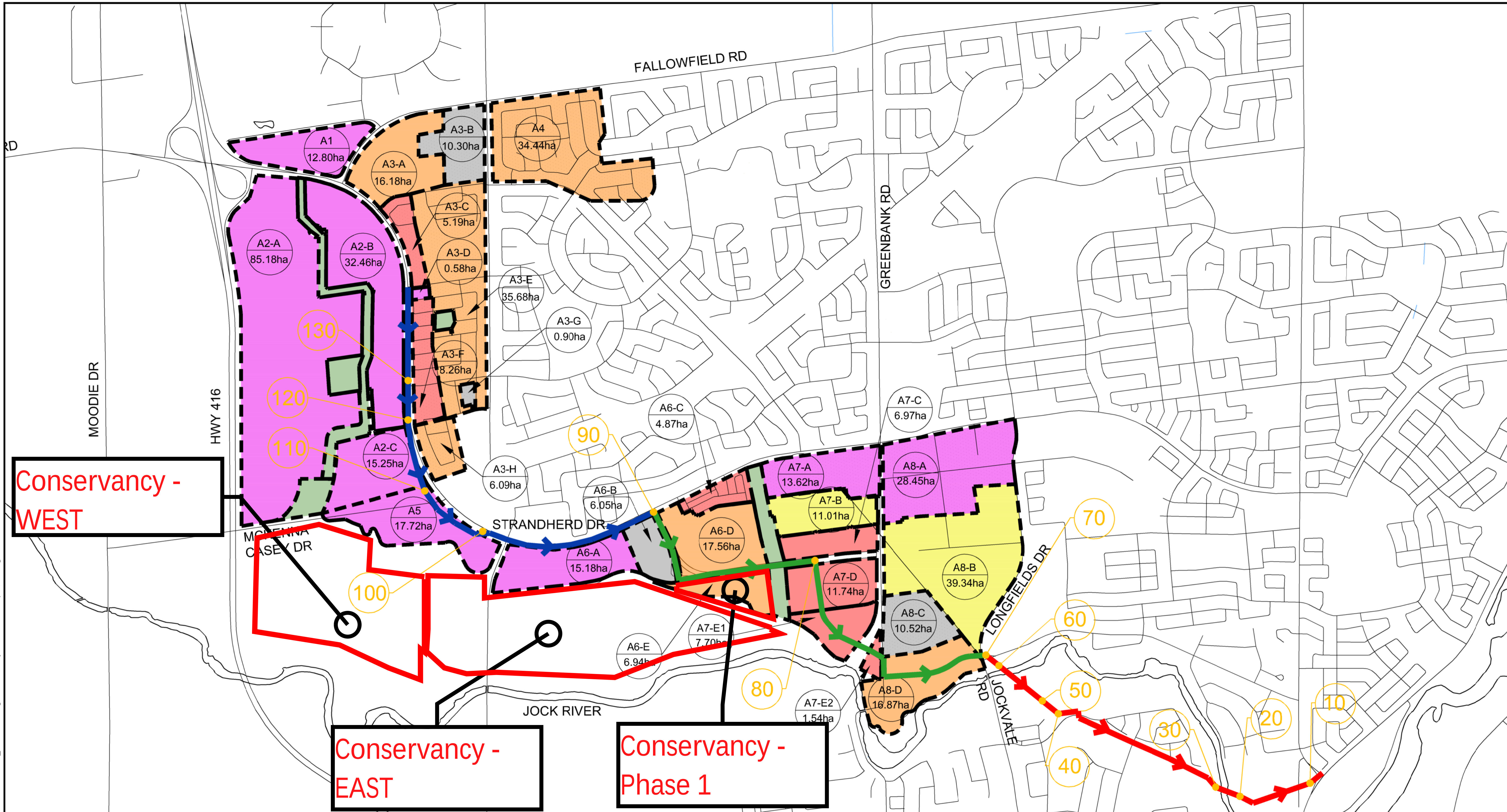
Table 6: Updated Allocation of Commercial, Institutional and Residential Demands to Phases 2 & 3 (Nodes 70 – 130) of the SNC by Collection Area

Collection Area	Upstream Node	Existing / Proposed Development	Existing / Proposed Land Use	Area (ha)	Estimated Number of Residential Units	Population Density (persons / ha)	Comment	Reference
A1	130	Proposed	Commercial	12.80	-	-	O'Keefe Court – Conceptual site plan shows proposed commercial.	Conceptual Plans for O'Keefe Court
A2-A	130	Proposed	Commercial	85.18	-	-	CitiGate – Analysis uses same approach as the design for CitiGate.	Detailed Servicing and SWM Report (Phase 1) (Novatech, 2014)
A2-B	130	Proposed	Commercial	32.46	-	-		
A2-C	120	Proposed	Commercial (ex. Snow dump)	15.25	-	-	Existing snow dump facility assumed to be future commercial.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012)
A3-A	130	Proposed	Low Density Residential	16.18	461	95.2	Havencrest – Existing single family units.	Havencrest Design Report (IBI, 2013)
A3-B	130	Existing	Institutional	10.30	-	-	Cedarview Middle School and Cedarview Alliance Church.	Aerial Photos / Site Visits
A3-C	130	Existing	Medium Density Residential	5.19	311	162	Existing townhouse units.	
A3-D	130	Existing	Commercial	0.58	-	-	Existing commercial buildings.	
A3-E	130	Existing	Low Density Residential	35.68	999	95.2	Existing single family units.	
A3-F	130	Existing	Medium Density Residential	8.26	496	162.0	Existing townhouse units.	
A3-G	130	Existing	Institutional	0.90	-	-	Ottawa Torah Centre Chibad.	
A3-H	120	Existing	Low Density Residential	6.09	171	95.2	Existing single family units.	
A4	130	Existing	Low Density Residential	34.44	964	95.2	Existing single family units currently serviced by Jockvale pump station; to be redirected to SNC.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012); based on 2011 Census.
A5	110	Proposed	Commercial	17.72	-	-	Proposed commercial south of McKenna Casey Drive.	Site Visits
A6-A	100	Proposed	Commercial	15.18	-	-	Proposed commercial south of Strandherd Drive; east of Borrisokane Road.	Conceptual Plan for Lands Adjacent the Kennedy-Burnett SWMF provided by Minto (2015)
A6-B	100	Proposed	Institutional	6.05			Proposed school site on Minto property.	
A6-C	90	Existing	Medium Density Residential	4.87	292	162.0	Existing townhouse units.	Aerial Photos / Site Visits
A6-D	90	Proposed	Low Density Residential	17.56	492	95.2	Proposed single family units on lands owned by Minto / Mion.	Conceptual Plans for Lands Adjacent the Kennedy-Burnett SWMF provided by land owners.
A6-E	90	Proposed	Low Density Residential	6.94	203	95.2	Proposed single family units on lands owned by Pavic / Braovac.	
A7-A	80	Existing	Commercial	13.62	-	-	Existing large retail stores (commercial).	Aerial Photos
A7-B	80	Proposed	High Density Residential	11.01	826	135.0	Proposed high density units on lands owned by Richcraft / Trinity.	Conceptual Plans for Lands Adjacent the Kennedy-Burnett SWMF provided by land owners.
A7-C	80	Proposed	Medium Density Residential	6.97	418	162.0	Proposed Medium density units on lands owned by Mion.	
A7-D	80	Proposed	Medium Density Residential	11.74	704	162.0	Proposed Medium density units on lands owned by Caivan.	
A7-E1/E2	80	Proposed	Medium Density Residential	9.24	554	162.0	Proposed Medium density units on lands owned by Claridge.	
A8-A	80	Existing	Commercial	28.45	-	-	Existing Barrhaven Market Place (commercial).	Aerial Photos / Site Visits
A8-B	80	Proposed	High Density Residential	39.34	2951	135.0	Future development similar to Ampersands development.	Site Visits
A8-C	80	Existing	Institutional	10.52	-	-	Existing St. Joseph High School.	Aerial Photos / Site Visits
A8-D	80	Proposed	Low Density Residential	16.87	1012	162.0	Proposed 600 low density residential units.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012)



LEGEND

- EXISTING / PROPOSED HIGH DENSITY RESIDENTIAL
- EXISTING / PROPOSED MEDIUM DENSITY RESIDENTIAL
- EXISTING / PROPOSED LOW DENSITY RESIDENTIAL
- EXISTING / PROPOSED COMMERCIAL
- EXISTING / PROPOSED INSTITUTIONAL
- OTHER LANDS (OPEN SPACE, PARKS, AND SWMFS)
- SOUTH NEPEAN COLLECTOR PHASE 1
- SOUTH NEPEAN COLLECTOR PHASE 2
- SOUTH NEPEAN COLLECTOR PHASE 3
- 80 SOUTH NEPEAN COLLECTOR NODE ID

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SOUTH NEPEAN COLLECTOR SEWER

SANITARY DRAINAGE AREAS AND LAND USE

SCALE 1:20 000

DATE MAY 2019 | JOB 117190 | FIGURE FIG. 1

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PROJECT #: 117190
DESIGNED BY: CMS
CHECKED BY: RJD
DATE: December 5, 2018

SANITARY SEWER DESIGN SHEET

South Nepean Collector - Phase 2 & 3

Theoretical Current Operational Peak Wastewater Flow

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Location			Areas				Population				Individual Design Flows			Cumulative Design Flows				
Area I.D.	**Existing Land Use**	**Upstream Node**	**Gross Commercial Area (ha)**	**Gross Institutional Area (ha)**	**Gross Residential Area (ha)**	**Total Gross Area (ha)**	**Residential Popultation Density (people / ha)**	**Individual Residential Population**	**Cumulative Residential Population**	**Residential Peaking Factor (Harmon Eqn[1])**	**Commercial Peak Flow Rate[2] (17,000 L/ha/d) (L/s)**	**Institutional Peak Flow Rate[2] (17,000 L/ha/d) (L/s)**	**Infiltration / Inflow Rate (0.3 L/s/ha) (L/s)**	**Commercial (L/s)**	**Institutional (L/s)**	**Infiltration / Inflow (L/s)**	**Residential Peak Flow Rate (200 L/cap/d) (L/s)**	**Cumulative Peak Design Flow (L/s)**
A1	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A2-A	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A2-B	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A3-A	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A3-B	Institutional	130		10.30		10.30					0.0	2.0	3.1	0.0	2.0	3.1	0.0	5.1
A3-C	Medium Density Residential	130			5.19	5.19	162.0	841	841	2.40	0.0	0.0	1.6	0.0	2.0	4.6	4.7	11.3
A3-D	Commercial	130	0.58			0.58			841	2.40	0.1	0.0	0.2	0.1	2.0	4.8	4.7	11.6
A3-E	Low Density Residential	130			35.68	35.68	95.2	3397	4238	2.39	0.0	0.0	10.7	0.1	2.0	15.5	23.4	41.1
A3-F	Medium Density Residential	130			8.26	8.26	162	1338	5576	2.32	0.0	0.0	2.5	0.1	2.0	18.0	29.9	50.1
A3-G	Institutional	130		0.90		0.90			5576	2.32	0.0	0.2	0.3	0.1	2.2	18.3	29.9	50.5
A4	Low Density Residential*	130				0.00			5576	2.32	0.0	0.0	0.0	0.1	2.2	18.3	29.9	50.5
A2-C	Snow Dump Facility	120				0.00			5576	2.32	0.0	0.0	0.0	0.1	2.2	18.3	29.9	50.5
A3-H	Low Density Residential	120			6.09	6.09	95.2	580	6155	2.30	0.0	0.0	1.8	0.1	2.2	20.1	32.7	55.1
A5	Open Space	110				0.00			6155	2.30	0.0	0.0	0.0	0.1	2.2	20.1	32.7	55.1
A6-A	Open Space	100				0.00			6155	2.30	0.0	0.0	0.0	0.1	2.2	20.1	32.7	55.1
A6-B	Open Space	100				0.00			6155	2.30	0.0	0.0	0.0	0.1	2.2	20.1	32.7	55.1
A6-C	Medium Density Residential	90			4.87	4.87	162.0	789	6944	2.27	0.0	0.0	1.5	0.1	2.2	21.6	36.4	60.3
A6-D	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	0.1	2.2	21.6	36.4	60.3
A6-E	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	0.1	2.2	21.6	36.4	60.3
A7-A	Commercial	90	13.62			13.62			6944	2.27	2.7	0.0	4.1	2.8	2.2	25.6	36.4	67.1
A7-B	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	2.2	25.6	36.4	67.1
A7-C	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	2.2	25.6	36.4	67.1
A7-D	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	2.2	25.6	36.4	67.1
A7-E1/E2	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	2.2	25.6	36.4	67.1
A8-A	Commercial	80	28.45			28.45			6944	2.27	5.6	0.0	8.5	8.4	2.2	34.2	36.4	81.2
A8-B	Open Space	80				0.00			6944	2.27	0.0	0.0	0.0	8.4	2.2	34.2	36.4	81.2
A8-C	Institutional	80		10.52		10.52			6944	2.27	0.0	2.1	3.2	8.4	4.3	37.3	36.4	86.4
A8-D	Open Space	80				0.00			6944	2.27	0.0	0.0	0.0	8.4	4.3	37.3	36.4	86.4
ROW Along SNC Sewer Alignment	-	80				14.34			6944	2.27	0.0	0.0	4.3	8.4	4.3	41.6	36.4	90.7
TOTAL		***80***	***42.65***	***21.72***	***60.09***	***138.80***	***-***	***6944***	***6944***	***2.27***	***8.4***	***4.3***	***41.6***	***8.4***	***4.3***	***41.6***	***36.4***	***90.7***

Residential Land Use	Population Density (Units / ha)	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

Notes:

1. Harmon Equation = 1 + [14 / (4+(P/1000)$^{1/2}$)] x K

Where: P = population; K = correction factor = 0.6

2. Instituional / Commercial Peaking Factor = 1.0

Reported Design Flows / Assumptions:

1. Area A4: Existing single family units currently serviced by Jockvale pump station; currently not directed to SNC

PROJECT #: 117190
DESIGNED BY: CMS
CHECKED BY: RJD
DATE: December 5, 2018

SANITARY SEWER DESIGN SHEET

South Nepean Collector - Phase 2 & 3

Theoretical Future Full Service Peak Wastewater Flow

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Location			Areas				Population				Individual Design Flows			Cumulative Design Flows				
Area I.D.	**Existing / Proposed Land Use**	**Upstream Node**	**Gross Commercial Area (ha)**	**Gross Institutional Area (ha)**	**Gross Residential Area (ha)**	**Total Gross Area (ha)**	**Residential Popultation Density (people / ha)**	**Individual Residential Population**	**Cumulative Residential Population**	**Residential Peaking Factor (Harmon Eqn[1])**	**Commercial Peak Flow Rate[2] (28,000 L/ha/d) (L/s)**	**Institutional Peak Flow Rate[2] (28,000 L/ha/d) (L/s)**	**Infiltration / Inflow Rate (0.33 L/s/ha) (L/s)**	**Commercial (L/s)**	**Institutional (L/s)**	**Infiltration / Inflow (L/s)**	**Residential Peak Flow Rate (280 L/cap/d) (L/s)**	**Cumulative Peak Design Flow (L/s)**
A1	Commercial	130	12.80			12.80					6.2	0.0	4.2	6.2	0.0	4.2	0.0	10.4
A2-A	Commercial	130	85.18			85.18					41.4	0.0	28.1	47.6	0.0	32.3	0.0	80.0
A2-B	Commercial	130	32.46			32.46					15.8	0.0	10.7	63.4	0.0	43.0	0.0	106.5
A3-A	Low Density Residential	130			16.18	16.18	95.2	1540	1540	3.14	0.0	0.0	5.3	63.4	0.0	48.4	15.7	127.5
A3-B	Institutional	130		10.30		10.30			1540	3.14	0.0	3.3	3.4	63.4	3.3	51.8	15.7	134.2
A3-C	Medium Density Residential	130			5.19	5.19	162.0	841	2381	3.02	0.0	0.0	1.7	63.4	3.3	53.5	23.3	143.6
A3-D	Commercial	130	0.58			0.58			2381	3.02	0.3	0.0	0.2	63.7	3.3	53.7	23.3	144.0
A3-E	Low Density Residential	130			35.68	35.68	95.2	3397	5778	2.75	0.0	0.0	11.8	63.7	3.3	65.5	51.5	184.0
A3-F	Medium Density Residential	130			8.26	8.26	162	1338	7116	2.68	0.0	0.0	2.7	63.7	3.3	68.2	61.8	197.0
A3-G	Institutional	130		0.90		0.90			7116	2.68	0.0	0.3	0.3	63.7	3.6	68.5	61.8	197.6
A4	Low Density Residential	130			34.44	34.44	95.2	3279	10395	2.55	0.0	0.0	11.4	63.7	3.6	79.9	85.9	233.1
A2-C	Commercial (ex. snow dump)	120	15.25			15.25			10395	2.55	7.4	0.0	5.0	71.1	3.6	84.9	85.9	245.5
A3-H	Low Density Residential	120			6.09	6.09	95.2	580	10974	2.53	0.0	0.0	2.0	71.1	3.6	86.9	90.0	251.7
A5	Commercial	110	17.72			17.72			10974	2.53	8.6	0.0	5.8	79.7	3.6	92.7	90.0	266.1
A6-A	Commercial	100	15.18			15.18			10974	2.53	7.4	0.0	5.0	87.1	3.6	97.7	90.0	278.5
A6-B	Institutional	100		6.05		6.05			10974	2.53	0.0	2.0	2.0	87.1	5.6	99.7	90.0	282.5
A6-C	Medium Density Residential	90			4.87	4.87	162.0	789	11763	2.51	0.0	0.0	1.6	87.1	5.6	101.4	95.6	289.6
A6-D	Low Density Residential	90			17.56	17.56	95.2	1672	13435	2.46	0.0	0.0	5.8	87.1	5.6	107.1	107.2	307.0
A6-E	Low Density Residential	90			6.94	6.94	95.2	661	14096	2.44	0.0	0.0	2.3	87.1	5.6	109.4	111.7	313.8
A7-A	Commercial	90	13.62			13.62			14096	2.44	6.6	0.0	4.5	93.7	5.6	113.9	111.7	324.9
A7-B	High Density Residential	90			11.01	11.01	135.0	1486	15582	2.41	0.0	0.0	3.6	93.7	5.6	117.6	121.7	338.5
A7-C	Medium Density Residential	90			6.97	6.97	162.0	1129	16711	2.38	0.0	0.0	2.3	93.7	5.6	119.9	129.2	348.3
A7-D	Medium Density Residential	90			11.74	11.74	162.0	1902	18613	2.35	0.0	0.0	3.9	93.7	5.6	123.7	141.6	364.6
A7-E1/E2	Medium Density Residential	90			9.24	9.24	162.0	1497	20110	2.32	0.0	0.0	3.0	93.7	5.6	126.8	151.2	377.3
A8-A	Commercial	80	28.45			28.45			20110	2.32	13.8	0.0	9.4	107.5	5.6	136.2	151.2	400.5
A8-B	High Density Residential	80			39.34	39.34	135.0	5311	25421	2.24	0.0	0.0	13.0	107.5	5.6	149.2	184.4	446.7
A8-C	Institutional	80		10.52		10.52			25421	2.24	0.0	3.4	3.5	107.5	9.0	152.6	184.4	453.6
A8-D	Low Density Residential	80			16.87	16.87	120.9	2040	27461	2.21	0.0	0.0	5.6	107.5	9.0	158.2	196.9	471.6
ROW Along SNC Sewer Alignment	-	80				14.34			27461	2.21	0.0	0.0	4.7	107.5	9.0	162.9	196.9	476.3
TOTAL		***80***	***221.24***	***27.77***	***230.38***	***493.73***	***-***	***27461***	***27461***	***2.21***	***107.5***	***9.0***	***162.9***	***107.5***	***9.0***	***162.9***	***196.9***	***476.3***

Residential Land Use	Population Density (Units / ha)	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

Notes:

1. Harmon Equation = $1 + [14 / (4+(P/1000)^{1/2})] \times K$

Where: P = population; K = correction factor = 0.8

2. Commercial Peaking Factor = 1.5; Institutional Peaking Factor = 1.0

Reported Design Flows / Assumptions:

1. Area A4: Existing single family units currently serviced by Jockvale pump station to be redirected to SNC

2. Area A8-D: proposed 600 medium density residential units

See Note (2) in the DSEL "Barrhaven Conservancy - Evaluation of SNC Flows" design sheet

THE PRIOR NOVATECH SNC DESIGN SHEET HAD FLOWS AT 423.6 L/S AFTER AREA ID "A6-E".

THIS UPDATED PHASE 3 EVALUATION HAS A FLOW OF 313.8 l/S.

THE DSEL EVALUATION WITH NEW PARAMETERS AT THIS SAME NODE WITH CONSERVANCY WEST AND EAST INCLUDED IS ~397.95 (BUT IS LESS THAN THE PRIOR 423.6 L/S

SOUTH NEPEAN COLLECTOR (PHASE 3)
SANITARY SEWER DESIGN SHEET

DECEMBER 5 2018
JOB# 117190

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Engineers, Planners & Landscape Architects

LOCATION			Area				Population		Cumulative Design Flows					PROPOSED SEWER						
From MH	To MH	Upstream Node	Gross Commercial Area (ha)	Gross Institutional Area (ha)	Gross Residential Area (ha)	Total Gross Area (ha)	Cumulative Residential Population	Residential Peaking Factor (Harmon Eqn[1])	Commercial (L/s)	Institutional (L/s)	Infiltration / Inflow (L/s)	Residential Peak Flow Rate (280 L/cap/d) (L/s)	Cumulative Peak Design Flow (L/s)	Length (m)	Pipe Size (mm)	Type	Slope %	Capacity (L/s)	Full Flow Velocity (m/s)	Ratio (Q/Qfull)
SA 22	SA 21	120	146.27	11.20	105.84	263.31	10974	2.53	71.1	3.6	86.9	90.0	251.7	131.9	750	CONC	0.10	367.3	0.81	69%
SA 21	SA 20	120											251.7	90.6	750	CONC	0.10	367.3	0.81	69%
SA 20	SA 19	120											251.7	90.0	750	CONC	0.10	367.3	0.81	69%
SA 19	SA 18	120											251.7	72.1	750	CONC	0.10	367.3	0.81	69%
SA 18	SA 17	120											251.7	71.9	750	CONC	0.10	367.3	0.81	69%
SA 17	SA 16	120											251.7	71.4	750	CONC	0.10	367.3	0.81	69%
SA 16	SA 15	110	163.99	11.20	105.84	281.03	10974	2.53	79.7	3.6	92.7	90.0	266.1	73.2	750	CONC	0.10	367.3	0.81	72%
SA 15	SA 14	110											266.1	67.5	750	CONC	0.10	367.3	0.81	72%
SA 14	SA 13	110											266.1	56.6	750	CONC	0.10	367.3	0.81	72%
SA 13	SA 12	110											266.1	133.5	750	CONC	0.10	367.3	0.81	72%
SA 12	SA 11	110											266.1	150.0	750	CONC	0.10	367.3	0.81	72%
SA 11	SA 10	100	179.17	17.25	105.84	302.26	10974	2.53	87.1	5.6	99.7	90.0	282.5	97.8	750	CONC	0.10	367.3	0.81	77%
SA 10	SA 9	100											282.5	76.7	750	CONC	0.10	367.3	0.81	77%
SA 9	SA 8	100											282.5	79.7	750	CONC	0.10	367.3	0.81	77%
SA 8	SA 7	100											282.5	75.3	750	CONC	0.10	367.3	0.81	77%
SA 7	SA 6	100											282.5	84.9	750	CONC	0.10	367.3	0.81	77%
SA 6	SA 5	100											282.5	77.1	750	CONC	0.10	367.3	0.81	77%
SA 5	SA 4	100											282.5	78.9	750	CONC	0.10	367.3	0.81	77%
SA 4	SA 3	100											282.5	80.5	750	CONC	0.10	367.3	0.81	77%
SA 3	SA 2	100											282.5	150.0	750	CONC	0.10	367.3	0.81	77%
SA 2	SA 1	100											282.5	114.6	750	CONC	0.10	367.3	0.81	77%
SA 1	*EX 80*	100											282.5	12.4	750	CONC	0.10	367.3	0.81	77%

Design Parameters:

Residential Land Use	Population Density (Units / ha)	Persons per Unit	Persons per ha
Low Density (singles / semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row / townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

Notes:

1. Harmon Equation = 1 + [14 / (4+(P/1000)$^{1/2}$)] x K

Where: P = population; K = correction factor = 0.8

2. Commercial Peaking Factor = 1.5; Institutional Peaking Factor = 1.0

Reported Design Flows / Assumptions:

1. Area A4: Existing single family units currently serviced by Jockvale pump station to be redirected to SNC

2. Area A8-D: proposed 600 medium density residential units

M E M O R A N D U M

DATE: MAY 26, 2016

TO: JONATHAN KNOYLE – CITY OF OTTAWA

FROM: CONRAD STANG – NOVATECH

RE: SOUTH NEPEAN COLLECTOR PHASE 2: SANITARY FLOW CALCULATIONS

CC: EDSON DONNELLY – NOVATECH

1.0 PURPOSE

This memorandum provides the sanitary sewer flow calculations and design sheet for Phase 2 of the proposed South Nepean Collector (SNC). Sanitary design flows have been estimated for both current-day operational flows and future development peak design flows, based on the latest available planning information for the vacant lands within the SNC sewershed.

2.0 BACKGROUND

In January 1998, the Master Servicing Study for the South Nepean Urban Area provided a conceptual plan for water, wastewater and stormwater infrastructure. The preferred alternative for wastewater servicing was an east/west trunk sewer alignment that was to be completed in several phases. The proposed sanitary trunk sewer was initially called the Jock River Collector, but was renamed the South Nepean Collector during the original functional design study completed in 2003.

Phase 1 of the South Nepean Collector was completed in 2005 and currently terminates at a 2400mm maintenance hole located east of Longfields Drive, north of Bren-Maur Road. Phase 2 will extend the trunk sewer to Strandherd Drive at the intersection of the proposed transitway along the proposed extension to Chapman Mills Drive. Phase 3 will extend the trunk sewer along Strandherd Drive to the intersection of Maravista Drive.

The sanitary sewer flows were previously documented in the *South Nepean Collector – Functional Design Report and Update* (Dillon, 2012). A review of the sanitary flows provided in the Dillion Report based on the latest planning information for the vacant lands within the SNC sewershed was documented in the technical memorandum titled South Nepean Collector Phase 2: Hydraulics Review / Assessment (Novatech, 2015), which is attached to this memorandum. The results of the Hydraulics Review / Assessment (Novatech, 2015) were very similar to the results from the Dillion (2012) analysis.

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3.0 DESIGN PARAMETERS AND POPULATION ESTIMATES

3.1 Design Parameters

The sanitary design flow were calculated using the parameters from the City of Ottawa Sewer Design Guidelines (October 2012), and are summarized in **Table 1** and **Table 2**.

Table 1: Peak Design Flow Parameters

Land Use	Average Daily Flow	Peaking Factor	Peak Extraneous Flows
Residential	350 L/cap/day	Harmon Equation, K=1 (2.0 min – 4.0 max)	0.28 L/s/ha
Commercial	50,000 L/ha/day	1.5	
Institutional	50,000 L/ha/day	1.5	
Other*	0 L/ha/day	N/A	

**Open Space, Arterial ROW, SWM Blocks, etc. with no sanitary flow contribution (extraneous flow only)*

Table 2: Operational Design Flow Parameters

Land Use	Average Daily Flow	Peaking Factor	Peak Extraneous Flows
Residential	300 L/cap/day	Harmon Equation, K=0.6 (1.2 min – 2.4 max)	Dry weather 0.05-0.08 L/s/ha Wet Weather 0.15 - 0.20 L/s/ha (typical events) 0.28 L/s/ha (large/annual events) 0.30 - 0.50 L/s/ha (extreme events)
Commercial	17,000 L/ha/day	1.0 (non-coincident peak)	
Institutional	10,000 L/ha/day	1.0 (non-coincident peak)	

**There are no industrial areas identified within the tributary area.*

Harmon Equation $= 1 + \frac{14}{4+\left(\frac{P}{1000}\right)^{\frac{1}{2}}} \times K$

Where:

P = Population

K = Correction Factor:

- Peak Flow = 1
- Operational = between 0.4 to 0.6 (0.6 used)

3.2 Land Use Designations & Population Estimates

Population densities and unit counts for future residential development are based on the current concept plans for these areas, and are presented in **Table 3**.

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Table 3: Residential Land Use Population Densities

Residential Land Use	Units per ha	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

The land use designations shown in **Table 4** have been applied for the areas within Phases 2 and 3 of the SNC (Node 70 to 130). The sewershed areas and land use designations were delineated using aerial photos (existing development) and conceptual site plans (future development).

Table 4: Land Use Designations

Land Use Designation	
Secondary Plan	**SNC Design**
Residential	Residential (Low / Medium / High Density)
Institutional / Office	Institutional
Commercial	Commercial
Recreational	
Business Park	
Prestige Business Park	
Park/Open Space Area	Other*
Ex. Snow Disposal Facility (future commercial)	
Stormwater Management Facility	
Conservation Lands	
Arterial Right-of-Ways	

** No sanitary flow contribution - extraneous flows (inflow/infiltration) only.*

The overall residential population estimate and sewershed area for Phases 2 and 3 of the SNC is provided in **Table 5** below. It is assumed that the snow dump facility at the Stranderd Drive and McKenna Casey Drive will ultimately be re-zoned for commercial development.

Table 5: Population Estimates and Areas

Existing / Future	Estimated Population / Area	Novatech (2015)
Existing	Estimated Population	6,944 persons
	Gross Residential Area	60.09 ha
	Gross Commercial / Institutional Area	64.37 ha
	Total Sewershed Area	124.5 ha
Future (full service)	Estimated Population	27,312 persons
	Gross Residential Area	248.48 ha
	Gross Commercial / Institutional Area	228.82 ha
	Total Sewershed Area	477.3 ha

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4.0 SANITARY DESIGN FLOWS

The sanitary flow allocations for Phases 2 and 3 of the SNC are provided in **Table 6**. The corresponding sanitary drainage area plan is provided as **Figure 1**. Sanitary sewer flow calculations for Phases 2 and 3 and detailed sanitary sewer design sheets for Phase 2 are attached to this memorandum.

The estimated sanitary design flows from Phases 2 and 3 of the SNC (entering Node 70) are as follows:

- Present-Day Operational Design Flows (Theoretical) = 72.5 L/s
- Future Peak Design Flows = 634.2 L/s

The outlet for Phase 2 of the SNC is the existing 1050mm outlet pipe at the 2400mm maintenance hole (Node 70) located east of Longfields Drive, north of Bren-Maur Road. Given a minimum design slope of 0.10%, this sanitary trunk sewer would have a full flow capacity of 900.5 L/s. Therefore, the downstream sanitary trunk sewer would be at 70% capacity, based on the future peak design flow being 634.2 L/s.

ATTACHMENTS:

- Figure 1: Sanitary Drainage Areas and Land Use
- Sanitary Sewer Flow Calculations
- Sanitary Sewer Design Sheets (Phase 2)
- South Nepean Collector Phase 2: Hydraulics Review / Assessment (Novatech, 2015)

LICENSED PROFESSIONAL ENGINEER
May 26/16
C. M. STANG
100125708
Conrad Stang
PROVINCE OF ONTARIO

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Table 6: Updated Allocation of Commercial, Institutional and Residential Demands to Phases 2 & 3 (Nodes 70 – 130) of the SNC by Collection Area

Collection Area	Upstream Node	Existing / Proposed Development	Existing / Proposed Land Use	Area (ha)	Estimated Number of Residential Units	Population Density (persons / ha)	Comment	Reference
A1	130	Proposed	Commercial	12.80	-	-	O'Keefe Court – Conceptual site plan shows proposed commercial.	Conceptual Plans for O'Keefe Court
A2-A	130	Proposed	Commercial	85.18	-	-	CitiGate – Analysis uses same approach as the design for CitiGate.	Detailed Servicing and SWM Report (Phase 1) (Novatech, 2014)
A2-B	130	Proposed	Commercial	32.46	-	-		
A2-C	120	Proposed	Commercial (ex. Snow dump)	15.25	-	-	Existing snow dump facility assumed to be future commercial.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012)
A3-A	130	Proposed	Low Density Residential	16.48	461	95.2	Havencrest – Existing single family units.	Havencrest Design Report (IBI, 2013)
A3-B	130	Existing	Institutional	10.30	-	-	Cedarview Middle School and Cedarview Alliance Church.	Aerial Photos / Site Visits
A3-C	130	Existing	Medium Density Residential	5.19	311	162	Existing townhouse units.	
A3-D	130	Existing	Commercial	0.58	-	-	Existing commercial buildings.	
A3-E	130	Existing	Low Density Residential	35.68	999	95.2	Existing single family units.	
A3-F	130	Existing	Medium Density Residential	8.26	496	162.0	Existing townhouse units.	
A3-G	130	Existing	Institutional	0.90	-	-	Ottawa Torah Centre Chibad.	
A3-H	120	Existing	Low Density Residential	6.09	171	95.2	Existing single family units.	
A4	130	Existing	Low Density Residential	34.44	964	95.2	Existing single family units currently serviced by Jockvale pump station; to be redirected to SNC.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012); based on 2011 Census.
A5	110	Proposed	Commercial	17.72	-	-	Proposed commercial south of McKenna Casey Drive.	Site Visits
A6-A	100	Proposed	Institutional	20.70	-	-	Proposed school site on Minto property.	Conceptual Plan for Lands Adjacent the Kennedy-Burnett SWMF provided by Minto (2015)
A6-B	90	Existing	Medium Density Residential	4.87	292	162.0	Existing townhouse units.	Aerial Photos / Site Visits
A6-C	90	Proposed	Low Density Residential	10.11	283	95.2	Proposed single family units on lands owned by Minto.	Conceptual Plans for Lands Adjacent the Kennedy-Burnett SWMF provided by land owners.
A6-D	90	Proposed	Low Density Residential	5.59	157	95.2	Proposed single family units on lands owned by Mion.	
A6-E	90	Proposed	Low Density Residential	7.24	203	95.2	Proposed single family units on lands owned by Pavic / Braovac.	
A7-A	80	Existing	Commercial	13.62	-	-	Existing large retail stores (commercial).	Aerial Photos
A7-B	80	Proposed	High Density Residential	11.01	826	135.0	Proposed high density units on lands owned by Richcraft / Trinity.	Conceptual Plans for Lands Adjacent the Kennedy-Burnett SWMF provided by land owners.
A7-C	80	Proposed	Medium Density Residential	6.97	418	162.0	Proposed Medium density units on lands owned by Mion.	
A7-D	80	Proposed	Medium Density Residential	11.74	704	162.0	Proposed Medium density units on lands owned by Caivan.	
A7-E1/E2	80	Proposed	Medium Density Residential	9.24	554	162.0	Proposed Medium density units on lands owned by Claridge.	
A8-A	80	Existing	Commercial	28.45	-	-	Existing Barrhaven Market Place (commercial).	Aerial Photos / Site Visits
A8-B	80	Proposed	High Density Residential	39.34	2951	135.0	Future development similar to Ampersands development.	Site Visits
A8-C	80	Existing	Institutional	10.52	-	-	Existing St. Joseph High School.	Aerial Photos / Site Visits
A8-D	80	Proposed	Low Density Residential	16.87	1012	162.0	Proposed 600 low density residential units.	Functional Design Report and Update – SNC Phase 2 and 3 (Dillon, 2012)

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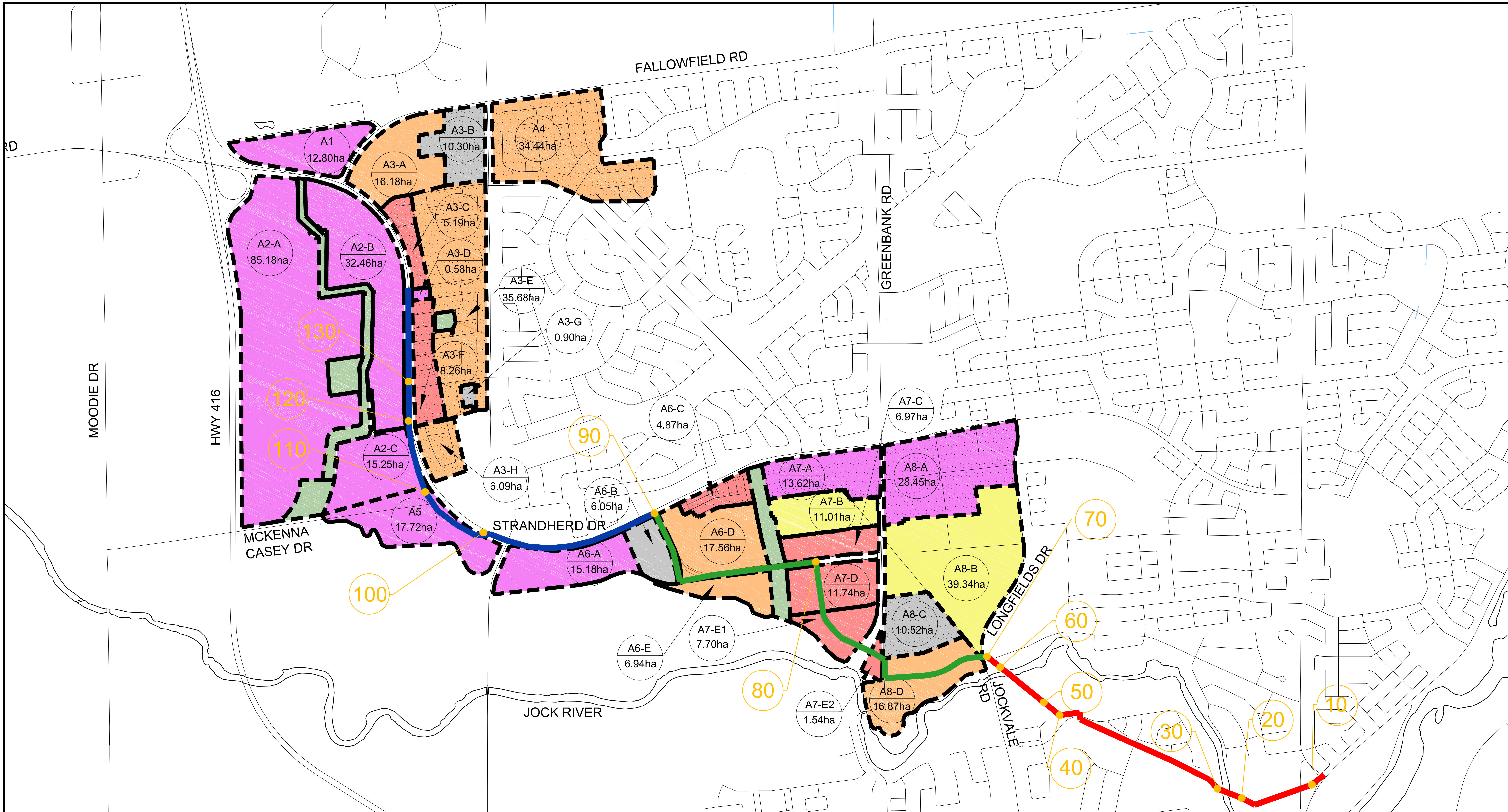
Attachment 1

Sanitary Drainage Areas and Land Use



LEGEND

- EXISTING / PROPOSED HIGH DENSITY RESIDENTIAL
- EXISTING / PROPOSED MEDIUM DENSITY RESIDENTIAL
- EXISTING / PROPOSED LOW DENSITY RESIDENTIAL
- EXISTING / PROPOSED COMMERCIAL
- EXISTING / PROPOSED INSTITUTIONAL
- OTHER LANDS (OPEN SPACE, PARKS, AND SWMFS)
- SOUTH NEPEAN COLLECTOR PHASE 1
- SOUTH NEPEAN COLLECTOR PHASE 2
- SOUTH NEPEAN COLLECTOR PHASE 3
- 80 SOUTH NEPEAN COLLECTOR NODE ID

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SOUTH NEPEAN COLLECTOR SEWER

SANITARY DRAINAGE AREAS AND LAND USE

SCALE		
1:20 000		
DATE: MAY 2016	JOB: 115075	FIGURE: FIG. 1

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Attachment 2

Sewer Flow Calculations

PROJECT #: 115075
DESIGNED BY: CMS
CHECKED BY: MJP
DATE: August 20, 2015

SANITARY SEWER DESIGN SHEET

South Nepean Collector - Phase 2 & 3

Theoretical Current Operational Peak Wastewater Flow

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Location			Areas				Population				Individual Design Flows			Cumulative Design Flows				
Area I.D.	Existing Land Use	Upstream Node	Gross Commercial Area (ha)	Gross Institutional Area (ha)	Gross Residential Area (ha)	Total Gross Area (ha)	Residential Popultation Density (people / ha)	Individual Residential Population	Cumulative Residential Population	Residential Peaking Factor (Harmon Eqn[1])	Commercial Peak Flow Rate[2] (17,000 L/ha/d) (L/s)	Institutional Peak Flow Rate[2] (10,000 L/ha/d) (L/s)	Infiltration / Inflow Rate (0.05 L/s/ha) (L/s)	Commercial (L/s)	Institutional (L/s)	Infiltration / Inflow (L/s)	Residential Peak Flow Rate (300 L/cap/d) (L/s)	Cumulative Peak Design Flow (L/s)
A1	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A2-A	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A2-B	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A3-A	Open Space	130				0.00					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A3-B	Institutional	130		10.30		10.30					0.0	1.2	0.5	0.0	1.2	0.5	0.0	1.7
A3-C	Medium Density Residential	130			5.19	5.19	162.0	841	841	2.71	0.0	0.0	0.3	0.0	1.2	0.8	7.9	9.9
A3-D	Commercial	130	0.58			0.58			841	2.71	0.1	0.0	0.0	0.1	1.2	0.8	7.9	10.0
A3-E	Low Density Residential	130			35.68	35.68	95.2	3397	4238	2.39	0.0	0.0	1.8	0.1	1.2	2.6	35.1	39.0
A3-F	Medium Density Residential	130			8.26	8.26	162	1338	5576	2.32	0.0	0.0	0.4	0.1	1.2	3.0	44.9	49.2
A3-G	Institutional	130		0.90		0.90			5576	2.32	0.0	0.1	0.0	0.1	1.3	3.0	44.9	49.4
A4	Low Density Residential*	130				0.00			5576	2.32	0.0	0.0	0.0	0.1	1.3	3.0	44.9	49.4
A2-C	Snow Dump Facility	120				0.00			5576	2.32	0.0	0.0	0.0	0.1	1.3	3.0	44.9	49.4
A3-H	Low Density Residential	120			6.09	6.09	95.2	580	6155	2.30	0.0	0.0	0.3	0.1	1.3	3.4	49.1	53.8
A5	Open Space	110				0.00			6155	2.30	0.0	0.0	0.0	0.1	1.3	3.4	49.1	53.8
A6-A	Open Space	100				0.00			6155	2.30	0.0	0.0	0.0	0.1	1.3	3.4	49.1	53.8
A6-B	Open Space	100				0.00			6155	2.30	0.0	0.0	0.0	0.1	1.3	3.4	49.1	53.8
A6-C	Medium Density Residential	90			4.87	4.87	162.0	789	6944	2.27	0.0	0.0	0.2	0.1	1.3	3.6	54.6	59.6
A6-D	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	0.1	1.3	3.6	54.6	59.6
A6-E	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	0.1	1.3	3.6	54.6	59.6
A7-A	Commercial	90	13.62			13.62			6944	2.27	2.7	0.0	0.7	2.8	1.3	4.3	54.6	63.0
A7-B	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	1.3	4.3	54.6	63.0
A7-C	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	1.3	4.3	54.6	63.0
A7-D	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	1.3	4.3	54.6	63.0
A7-E1/E2	Open Space	90				0.00			6944	2.27	0.0	0.0	0.0	2.8	1.3	4.3	54.6	63.0
A8-A	Commercial	80	28.45			28.45			6944	2.27	5.6	0.0	1.4	8.4	1.3	5.7	54.6	70.0
A8-B	Open Space	80				0.00			6944	2.27	0.0	0.0	0.0	8.4	1.3	5.7	54.6	70.0
A8-C	Institutional	80		10.52		10.52			6944	2.27	0.0	1.2	0.5	8.4	2.5	6.2	54.6	71.8
A8-D	Open Space	80				0.00			6944	2.27	0.0	0.0	0.0	8.4	2.5	6.2	54.6	71.8
ROW Along SNC Sewer Alignment	-	80				14.34			6944	2.27	0.0	0.0	0.7	8.4	2.5	6.9	54.6	72.5
TOTAL		***80***	***42.65***	***21.72***	***60.09***	***138.80***	***-***	***6944***	***6944***	***2.27***	***8.4***	***2.5***	***6.9***	***8.4***	***2.5***	***6.9***	***54.6***	***72.5***

Residential Land Use	Population Density (Units / ha)	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

Notes:

1. Harmon Equation = 1 + [14 / (4+(P/1000)$^{1/2}$)] x K

Where: P = population; K = correction factor = 0.6

2. Instituional / Commercial Peaking Factor = 1.0

Reported Design Flows / Assumptions:

1. Area A4: Existing single family units currently serviced by Jockvale pump station; currently not directed to SNC

PROJECT #: 115075
DESIGNED BY: CMS
CHECKED BY: MJP
DATE: August 20, 2015

SANITARY SEWER DESIGN SHEET

South Nepean Collector - Phase 2 & 3

Theoretical Future Full Service Peak Wastewater Flow

NOVATECH
Engineers, Planners & Landscape Architects

Location			Areas				Population				Individual Design Flows			Cumulative Design Flows				
Area I.D.	Existing / Proposed Land Use	Upstream Node	Gross Commercial Area (ha)	Gross Institutional Area (ha)	Gross Residential Area (ha)	Total Gross Area (ha)	Residential Popultation Density (people / ha)	Individual Residential Population	Cumulative Residential Population	Residential Peaking Factor (Harmon Eqn[1])	Commercial Peak Flow Rate[2] (50,000 L/ha/d) (L/s)	Institutional Peak Flow Rate[2] (50,000 L/ha/d) (L/s)	Infiltration / Inflow Rate (0.28 L/s/ha) (L/s)	Commercial (L/s)	Institutional (L/s)	Infiltration / Inflow (L/s)	Residential Peak Flow Rate (350 L/cap/d) (L/s)	Cumulative Peak Design Flow (L/s)
A1	Commercial	130	12.80			12.80					11.1	0.0	3.6	11.1	0.0	3.6	0.0	14.7
A2-A	Commercial	130	85.18			85.18					73.9	0.0	23.9	85.1	0.0	27.4	0.0	112.5
A2-B	Commercial	130	32.46			32.46					28.2	0.0	9.1	113.2	0.0	36.5	0.0	149.8
A3-A	Low Density Residential	130			16.18	16.18	95.2	1540	1540	3.67	0.0	0.0	4.5	113.2	0.0	41.1	22.9	177.2
A3-B	Institutional	130		10.30		10.30			1540	3.67	0.0	8.9	2.9	113.2	8.9	43.9	22.9	189.0
A3-C	Medium Density Residential	130			5.19	5.19	162.0	841	2381	3.53	0.0	0.0	1.5	113.2	8.9	45.4	34.0	201.6
A3-D	Commercial	130	0.58			0.58			2381	3.53	0.5	0.0	0.2	113.7	8.9	45.6	34.0	202.2
A3-E	Low Density Residential	130			35.68	35.68	95.2	3397	5778	3.19	0.0	0.0	10.0	113.7	8.9	55.5	74.6	252.8
A3-F	Medium Density Residential	130			8.26	8.26	162	1338	7116	3.10	0.0	0.0	2.3	113.7	8.9	57.9	89.4	269.9
A3-G	Institutional	130		0.90		0.90			7116	3.10	0.0	0.8	0.3	113.7	9.7	58.1	89.4	270.9
A4	Low Density Residential	130			34.44	34.44	95.2	3279	10395	2.94	0.0	0.0	9.6	113.7	9.7	67.8	123.7	314.9
A2-C	Commercial (ex. snow dump)	120	15.25			15.25			10395	2.94	13.2	0.0	4.3	127.0	9.7	72.0	123.7	332.4
A3-H	Low Density Residential	120			6.09	6.09	95.2	580	10974	2.91	0.0	0.0	1.7	127.0	9.7	73.7	129.6	340.0
A5	Commercial	110	17.72			17.72			10974	2.91	15.4	0.0	5.0	142.4	9.7	78.7	129.6	360.3
A6-A	Commercial	100	15.18			15.18			10974	2.91	13.2	0.0	4.3	155.5	9.7	82.9	129.6	377.8
A6-B	Institutional	100		6.05		6.05			10974	2.91	0.0	5.3	1.7	155.5	15.0	84.6	129.6	384.7
A6-C	Medium Density Residential	90			4.87	4.87	162.0	789	11763	2.88	0.0	0.0	1.4	155.5	15.0	86.0	137.4	393.9
A6-D	Low Density Residential	90			17.56	17.56	95.2	1672	13435	2.83	0.0	0.0	4.9	155.5	15.0	90.9	153.8	415.2
A6-E	Low Density Residential	90			6.94	6.94	95.2	661	14096	2.81	0.0	0.0	1.9	155.5	15.0	92.9	160.2	423.6
A7-A	Commercial	90	13.62			13.62			14096	2.81	11.8	0.0	3.8	167.4	15.0	96.7	160.2	439.2
A7-B	High Density Residential	90			11.01	11.01	135.0	1486	15582	2.76	0.0	0.0	3.1	167.4	15.0	99.8	174.3	456.4
A7-C	Medium Density Residential	90			6.97	6.97	162.0	1129	16711	2.73	0.0	0.0	2.0	167.4	15.0	101.7	184.9	468.9
A7-D	Medium Density Residential	90			11.74	11.74	162.0	1902	18613	2.68	0.0	0.0	3.3	167.4	15.0	105.0	202.4	489.7
A7-E1/E2	Medium Density Residential	90			9.24	9.24	162.0	1497	20110	2.65	0.0	0.0	2.6	167.4	15.0	107.6	215.9	505.8
A8-A	Commercial	80	28.45			28.45			20110	2.65	24.7	0.0	8.0	192.0	15.0	115.5	215.9	538.5
A8-B	High Density Residential	80			39.34	39.34	135.0	5311	25421	2.55	0.0	0.0	11.0	192.0	15.0	126.6	262.4	596.0
A8-C	Institutional	80		10.52		10.52			25421	2.55	0.0	9.1	2.9	192.0	24.1	129.5	262.4	608.1
A8-D	Low Density Residential	80			16.87	16.87	120.9	2040	27461	2.52	0.0	0.0	4.7	192.0	24.1	134.2	279.8	630.2
ROW Along SNC Sewer Alignment	-	80				14.34			27461	2.52	0.0	0.0	4.0	192.0	24.1	138.2	279.8	634.2
TOTAL		***80***	***221.24***	***27.77***	***230.38***	***493.73***	***-***	***27461***	***27461***	***2.52***	***192.0***	***24.1***	***134.2***	***192.0***	***24.1***	***138.2***	***279.8***	***634.2***

Residential Land Use	Population Density (Units / ha)	Persons per Unit	Persons per ha
Low Density (singles and semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row/townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

Notes:

1. Harmon Equation = $1 + [14 / (4+(P/1000)^{1/2})] \times K$

Where: P = population; K = correction factor = 1.0

2. Instituional / Commercial Peaking Factor = 1.5

Reported Design Flows / Assumptions:

1. Area A4: Existing single family units currently serviced by Jockvale pump station to be redirected to SNC

2. Area A8-D: proposed 600 medium density residential units

THIS PRIOR NOVETECH SNC DESIGN SHEET HAD DESIGN FLOWS AT 423.6 L/S AFTER AREA ID "A6-E'.

THE DSEL EVALUATION WITH NEW PARAMTERS AT THIS SAME NODE WITH CONSERVANCY WEST AND EAST INCLUDED IS ~397.95 < 423.6 L/S

Attachment 3

Sanitary Sewer Design Sheets (Phase 2)

SOUTH NEPEAN COLLECTOR (PHASE 2)
SANITARY SEWER DESIGN SHEET

MAY 26, 2016
JOB# 115075

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION			Area					Population				Individual Design Flows			Cumulative Design Flows					PROPOSED SEWER						
From MH	To MH	Upstream Node	Gross Commercial Area (ha)	Gross Institutional Area (ha)	Gross Residential Area (ha)	Right-of-Way (ha)	Total Gross Area (ha)	Residential Popultation Density (people / ha)	Individual Residential Population	Cumulative Residential Population	Residential Peaking Factor (Harmon Eqn[1])	Commercial Peak Flow Rate[2] (50,000 L/ha/d) (L/s)	Institutional Peak Flow Rate[2] (50,000 L/ha/d) (L/s)	Infiltration / Inflow Rate (0.28 L/s/ha) (L/s)	Commercial (L/s)	Institutional (L/s)	Infiltration / Inflow (L/s)	Residential Peak Flow Rate (350 L/cap/d) (L/s)	Cumulative Peak Design Flow (L/s)	Length (m)	Pipe Size (mm)	Type	Slope %	Capacity (L/s)	Full Flow Velocity (m/s)	Ratio (Q/Qfull)
MHSA 1	MHSA 2	90	192.79	17.25	174.17	0.00	384.21	1678	20110	20110	2.65	167.352	14.97	107.58	167.4	15.0	107.6	215.9	505.8	57.3	900	CONC	0.10	597.2	0.91	85%
MHSA 2	MHSA 3	90																	505.8	57.3	900	CONC	0.10	597.2	0.91	85%
MHSA 3	MHSA 4	90																	505.8	73.9	900	CONC	0.10	597.2	0.91	85%
MHSA 4	MHSA 5	90																	505.8	34.6	900	CONC	0.10	597.2	0.91	85%
MHSA 5	MHSA 6	90																	505.8	42.8	900	CONC	0.10	597.2	0.91	85%
MHSA 6	MHSA 7	90																	505.8	84.4	900	CONC	0.10	597.2	0.91	85%
MHSA 7	MHSA 8	90																	505.8	16.5	900	CONC	0.10	597.2	0.91	85%
MHSA 8	MHSA 9	90																	505.8	85.4	900	CONC	0.10	597.2	0.91	85%
MHSA 9	MHSA 10	90																	505.8	70.6	900	CONC	0.10	597.2	0.91	85%
MHSA 10	MHSA 11	90																	505.8	70.6	900	CONC	0.10	597.2	0.91	85%
MHSA 11	MHSA 12	90																	505.8	77.8	900	CONC	0.10	597.2	0.91	85%
MHSA 12	MHSA 13	90																	505.8	77.8	900	CONC	0.10	597.2	0.91	85%
MHSA 13	MHSA 14	90																	505.8	77.8	900	CONC	0.10	597.2	0.91	85%
MHSA 14	MHSA 15	90																	505.8	25.4	900	CONC	0.10	597.2	0.91	85%
MHSA 15	MHSA 16	90																	505.8	34.2	900	CONC	0.10	597.2	0.91	85%
MHSA 16	MHSA 17	90																	505.8	86.7	900	CONC	0.10	597.2	0.91	85%
MHSA 17	MHSA 18	90																	505.8	34.3	900	CONC	0.10	597.2	0.91	85%
MHSA 18	MHSA 19	90																	505.8	68.6	900	CONC	0.10	597.2	0.91	85%
MHSA 19	MHSA 20	90																	505.8	65.5	900	CONC	0.10	597.2	0.91	85%
MHSA 20	MHSA 21	80	221.24	27.77	230.38	14.34	493.73	256	7351	27461	2.52	192.049	24.11	138.24	192.0	24.1	138.2	279.8	634.2	18.2	1050	CONC	0.10	900.9	1.01	70%
MHSA 21	MHSA 22	80																	634.2	81.9	1050	CONC	0.10	900.9	1.01	70%
MHSA 22	MHSA 23	80																	634.2	84.7	1050	CONC	0.10	900.9	1.01	70%
MHSA 23	MHSA 24	80																	634.2	77.4	1050	CONC	0.10	900.9	1.01	70%
MHSA 24	MHSA 25	80																	634.2	45.5	1050	CONC	0.10	900.9	1.01	70%
MHSA 25	MHSA 26	80																	634.2	35.8	1050	CONC	0.10	900.9	1.01	70%
MHSA 26	MHSA 27	80																	634.2	83.3	1050	CONC	0.10	900.9	1.01	70%
MHSA 27	MHSA 28	80																	634.2	74.4	1050	CONC	0.10	900.9	1.01	70%
MHSA 28	MHSA 29	80																	634.2	77.3	1050	CONC	0.10	900.9	1.01	70%
MHSA 29	MHSA 30	80																	634.2	83.8	1050	CONC	0.10	900.9	1.01	70%
MHSA 30	MHSA 31	80																	634.2	42.3	1050	CONC	0.10	900.9	1.01	70%
MHSA 31	MHSA 32	80																	634.2	100.6	1050	CONC	0.10	900.9	1.01	70%
MHSA 32	MHSA 33	80																	634.2	13.9	1050	CONC	0.10	900.9	1.01	70%
MHSA 33	MHSA 34	80																	634.2	99.9	1050	CONC	0.10	900.9	1.01	70%
MHSA 34	MHSA 35	80																	634.2	99.9	1050	CONC	0.10	900.9	1.01	70%
MHSA 35	MHSA 36	80																	634.2	88.7	1050	CONC	0.10	900.9	1.01	70%
MHSA 36	MHSA 37	80																	634.2	88.8	1050	CONC	0.10	900.9	1.01	70%
MHSA 37	MHSA 38	80																	634.2	90.3	1050	CONC	0.10	900.9	1.01	70%
MHSA 38	MHSA 39	80																	634.2	87.5	1050	CONC	0.10	900.9	1.01	70%

Design Parameters:

Residential Land Use	Population Density (Units / ha)	Persons per Unit	Persons per ha
Low Density (singles / semis)	26 – 28 (28 used)	2.7 – 3.4 (3.4 used)	95.2
Medium Density (row / townhouse)	50 – 60 (60 used)	2.7	162.0
High Density (apartments)	60 – 75 (75 used)	1.8	135.0

Notes:

1. Harmon Equation = $1 + [14 / (4+(P/1000)^{1/2})] \times K$

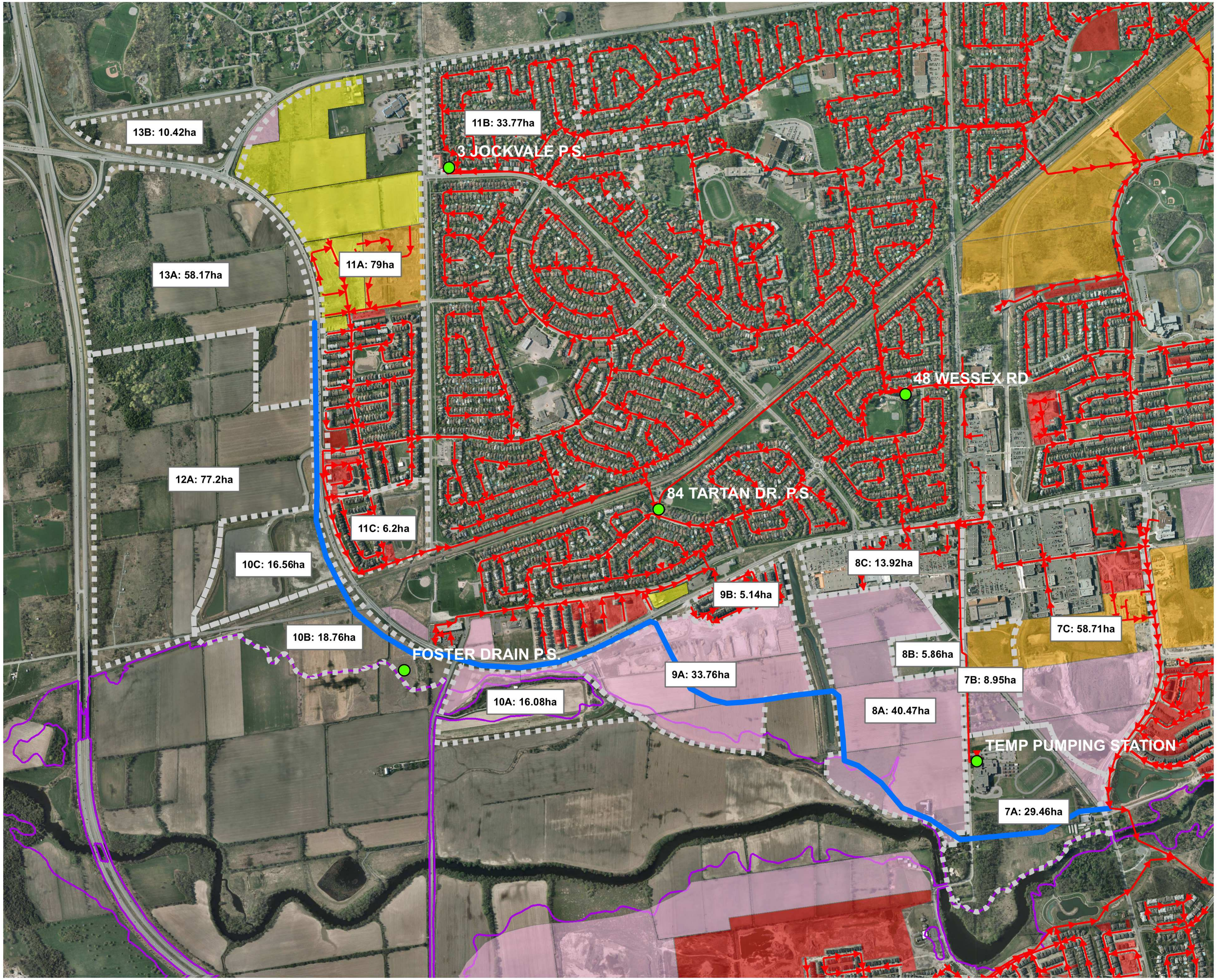
Where: P = population; K = correction factor = 1.0

2. Instituional / Commercial Peaking Factor = 1.5

Reported Design Flows / Assumptions:

1. Area A4: Existing single family units currently serviced by Jockvale pump station to be redirected to SNC

2. Area A8-D: proposed 600 medium density residential units



City of Ottawa
South Nepean Collector

Figure 01
Existing Sanitary Network and Collection Areas

Pump Station
Existing Sanitary Main (With Flow Direction)
Proposed Alignment for South Nepean Collector
Collection Area

DEVELOPMENT STATUS
Registered
Draft Approved
Pending
No Plan
Floodplain

NOT TO SCALE

MAP DRAWING INFORMATION:
DATA PROVIDED BY THE CITY OF OTTAWA

MAP CREATED BY: BC
MAP CHECKED BY: MBM
MAP PROJECTION: NO PROJECTION

FILE LOCATION: \\Dillon.ca\dillon_dfs\Ottawa\Ottawa CA\CAD\2011\115681\Design_GIS\MXD\Figure01c_ExistingSanitaryNetwork.mxd

DILLON CONSULTING

PROJECT: 11-5681
STATUS: FINAL
DATE: 18/07/12

Table 5.1: Allocation of Commercial/Institutional and Residential Demands to SNC by Collection Area

Collection Area	Discharging Node	Estimated from GIS			City of Ottawa VURL Data			Other Space [1] (ha)	Population (PE)	Residential Density (PE/net ha)	Comments	Additional Source(s)
		Gross Institutional/Commercial (ha)	Gross Residential (ha)	Gross Area (ha)	Net Residential (ha)	Units (#)	Unit Density (#/ha)					
7A	70	13.5	7.4	29.5	4.0	605	0.3	9.1	1637	4.25	Flow calculations include St Joseph H.S. Pump Station firm capacity of 7.0 L/s Additional 600 units (TAC)	3.4ppu (TAC)
7B		0.0	9.24	9.24	6.23	1474	136.7	3.0	3321	638.8	Population from split VURL allocated by area. VURL parcel id 323 - inconsistency between net and gross reported area.	2.7ppu (TAC)
8A		0.0	40.0	40.0	24.1	4462	185.1	15.9	12047.4	499.9		2.7ppu (TAC)
8B		5.9	0.0	5.9	0.0	0	0	0.0			Future Commercial area	
8C		13.9	0.0	13.9	0.0	0	0	0.0			Commercial area includes Home Depot	
9A	80	0.0	33.8	33.8	18.6	635	34.1	15.2	2210	116.2		3.4ppu (TAC)
10A	90	0.0	16.1	16.1	9.7	451	28.0	6.4	1533.4	158.0	Assume net population = 60% gross.	3.4ppu (TAC)
10B	100	18.8	0.0	35.3	0.0	0	0	16.5			Allocated as potential future I/C use as directed by TAC	
10C	110	16.6	0.0	35.3	0.0	0	0	18.7			Area includes current Municipal Snow Dump. Flow allowance is made for potential future I/C use	
11C		0.0	6.2	6.2	Note 2			2.5	306	82.7	This area is south of '11 block' in the existing development	From IBI Apr 2010 Report Figure 1
11A	120	12.5	66.5	79.0				26.6	3923	98.3	Institutional includes 4.38ha church site and 6.89 ha institution at northeast corner, as well and Claridge Commercial (0.56ha) and DCR/Phoenix Commercial (0.64ha)	From IBI Apr2010 Report Figure 1
11B		0.0	37.0	37.0				14.8	1550	69.8	Presently serviced by Jockvale pump station; to be redirected to SNC.	Estimated from 2011 Census Block data
12A		77.2	0.0	77.2				0.0			Allow sanitary peak flow 79.0 L/s	Novatech, Employment Lands Report, Revised Jan 2012
13A	130	58.5	0.0	58.5				0.0			Allow sanitary peak flow 62.8 L/s plus Collection Area 13B, total 82.2 L/s	
13B		12.5	0.0	12.5				0.0			Allow sanitary peak flow 19.4 L/s; gravity discharge to Collection Area 13A	IBI/Novatech

Notes:
1. Other space includes other residential space accounting for the difference between gross area (measured with GIS) and net area (provided in VURL data), such as sidewalks, roads, greenspace, etc.
2. Collection Area 11A and 11B population and land use as identified under Additional Source(s). Other space reported as 60% of gross residential area, consistent with VURL average.

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2012 Operational current day

CITY OF OTTAWA
SOUTH NEPEAN COLLECTOR SEWER
SANITARY SEWER DESIGN SHEET - Operational Service (Average Flow Design Parameters)

Sheet 1 of 1

TRIBUTARY AREA	Design Factors	LOCATION FROM	LOCATION TO	AREA (ha) Gross ICI	Net ICI	Other ICI space (Green, Sidewalks, roads)	Gross RESIDENTIAL Area	Net Residential Area	Other Res (Green, Sidewalks, roads)	TOTAL AREA (Gross ICI plus Gross Residential)	INDIVIDUAL POP	DENSITY (po./ha.)	CUMULATIVE POP	AREA (ha.)	RESIDENTIAL PEAKING FACTOR	RESIDENT. FLOW (L/s)	COMMERCIAL & INSTITUTION PEAKING FACTOR	CUM. AREA	I.C.I. FLOW (l/s)	INFIL. INFLOW Q(p) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)
13A	1			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		0	0.0	4.50	0.00	1.00	0.00	0.00	0.00	0.00
13B	1		Node 130	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		0	0.0	4.50	0.00	1.00	0.00	0.00	0.00	0.00
12A	1	Node 130		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		0	0.0	4.50	0.00	1.00	0.00	0.00	0.00	0.00
11A	1			12.5	9.4	3.1	66.5	8.0	58.5	79.0	1196	148.76	1196	79.0	3.75	15.57	1.00	12.50	2.00	3.95	21.52
11B	1		Node 120	0.0	0.0	0.0	37.0	22.2	14.8	37.0	1550	69.82	2746	116.0	3.47	33.13	1.00	12.50	2.00	5.80	40.93
11C	1	Node 120		0.0	0.0	0.0	6.2	3.7	2.5	6.2	306	82.26	3052	122.2	3.44	36.41	1.00	12.50	2.00	6.11	44.52
10C	1		Node 110	16.6	12.5	4.2	0.0	0.0	0.0	16.6	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
10B	1	Node 110	Node 100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
10A	1	Node 100	Node 90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
9A	1	Node 90	Node 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
8A	1	Node 80		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3052	138.8	3.44	36.41	1.00	29.10	4.66	6.94	48.01
8B	1			5.9	4.4	1.5	0.0	0.0	0.0	5.9	0		3052	144.7	3.44	36.41	1.00	35.00	5.60	7.24	49.25
8C	1			13.9	10.4	3.5	0.0	0.0	0.0	13.9	0		3052	158.6	3.44	36.41	1.00	48.90	7.82	7.93	52.17
7A	1			13.5	10.1	3.4	16.0	1.4	14.6	29.5	17	12.14	3069	188.1	3.43	36.59	1.00	62.40	9.98	9.41	55.93
7B	1		Node 70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		3069	188.1	3.43	36.59	1.00	62.40	9.98	9.41	55.93
										188.1											

TRIBUTARY AREA	PROPOSED SEWER LENGTH (m)	GROUND ELEVATION (m)	DEPTH OF COVER (m)	PIPE SIZE (m)	INVERT 1 (m)	INVERT 2 (m)	PIPE TYPE	GRADE	CAPACITY (L/s)	Q(d)/Q(c)	VELOCITY at capacity (m/s)	OPERATIONAL DESIGN DEPTH (m)	OPERATIONAL DESIGN VELOCITY (m/s)
13A													
13B		95.14	5.43	0.750		88.96							
12A													
11A													
11B	531.89	93.60	4.42	0.750	88.96	88.43	Conc.	0.10%	353.24	0.13	0.80	0.20	0.58
11C													
10C	497.82	93.44	4.76	0.750	88.43	87.93	Conc.	0.10%	353.24	0.14	0.80	0.20	0.58
10B	603.17	93.03	4.95	0.750	87.93	87.33	Conc.	0.10%	353.24	0.14	0.80	0.20	0.58
10A	430.49	93.75	6.03	0.825	87.33	86.90	Conc.	0.10%	455.17	0.11	0.85	0.21	0.61
9A	1268.65	92.37	5.84	0.900	86.90	85.63	Conc.	0.10%	573.71	0.08	0.90	0.18	0.56
8A													
8B													
8C													
7A													
7B	1448.98	91.24	6.01	1.050	85.63	84.18	Conc.	0.10%	864.51	0.06	1.00	0.18	0.56

DEFAULTS

q=AVERAGE DAILY FLOW	300	L/CAP.D
I=UNIT OF PEAK EXTR.FLOW	0.050	L/Ha.s
Mannings 'n'	0.013	
q=AVERAGE COMMERCIAL AND INSTITUTIONAL	0.16	L/Ha.s

DESIGN	DJG
CHECKED	
TODAY:	7/18/2012

DILLON CONSULTING

Project 11-5681

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2012 Full Service (Peak)

CITY OF OTTAWA

SOUTH NEPEAN COLLECTOR SEWER

SANITARY SEWER DESIGN SHEET - Full Service (Peak Flow Design Parameters)

Sheet 1 of 1

TRIBUTARY AREA	Design Factors	LOCATION FROM	LOCATION TO	AREA (ha) Gross ICI	Net ICI	Other ICI space (Green, Sidewalks, roads)	Gross RESIDENTIAL Area	Net Residential Area	Other Res (Sidewalks, roads)	TOTAL AREA (Gross ICI plus Gross Residential)	INDIVIDUAL POP	DENSITY (pers/net ha.)	CUMULATIVE POP	Total I/C and Res AREA (ha.)	RESIDENTIAL PEAKING FACTOR	RESIDENT. FLOW (L/s)	COMMERCIAL & INSTITUTION PEAKING FACTOR	I/C CUM. AREA	I/C FLOW (l/s)	INFIL. INFLOW Q(p) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)
13A	1			58.5	43.9	14.6	0.0	0.0	0.0	58.5	0		0	58.5	4.50	0.00	1.50	58.50	50.90	16.38	67.28
13B	1		Node 130	12.5	9.4	3.1	0.0	0.0	0.0	12.5	0		0	71.0	4.50	0.00	1.50	71.00	61.77	19.88	81.65
12A	1	Node 130		77.2	57.9	19.3	0.0	0.0	0.0	77.2	0		0	148.2	4.50	0.00	1.50	148.20	128.93	41.50	170.43
11A	1			12.5	9.4	3.1	66.5	39.9	26.6	79.0	3923	98.32	3923	227.2	3.34	53.09	1.50	160.70	139.81	63.62	256.52
11B	1		Node 120	0.0	0.0	0.0	37.0	22.2	14.8	37.0	1550	69.82	5473	264.2	3.21	71.13	1.50	160.70	139.81	73.98	284.92
11C		Node 120		0.0	0.0	0.0	6.2	3.7	2.5	6.2	306	82.26	5779	270.4	3.19	74.59	1.50	160.70	139.81	75.71	290.11
10C	1		Node 110	16.6	12.5	4.2	0.0	0.0	0.0	16.6	0		5779	287.0	3.19	74.59	1.50	177.30	154.25	80.36	309.20
10B	1	Node 110	Node 100	18.8	14.1	4.7	0.0	0.0	0.0	18.8	0		5779	305.8	3.19	74.59	1.50	196.10	170.61	85.62	330.82
10A	1	Node 100	Node 90	0.0	0.0	0.0	16.1	9.7	6.4	16.1	1533	158.04	7312	321.9	3.09	91.48	1.50	196.10	170.61	90.13	352.22
9A	1	Node 90	Node 80	0.0	0.0	0.0	33.8	18.6	15.2	33.8	2161	116.18	9473	355.7	2.98	114.28	1.50	196.10	170.61	99.60	384.48
8A	1	Node 80		0.0	0.0	0.0	40.0	24.1	15.9	40.0	12047	499.88	21520	395.7	2.62	228.45	1.50	196.10	170.61	110.80	509.85
8B	1			5.9	4.4	1.5	0.0	0.0	0.0	5.9	0		21520	401.6	2.62	228.45	1.50	202.00	175.74	112.45	516.64
8C	1			13.9	10.4	3.5	0.0	0.0	0.0	13.9	0		21520	415.5	2.62	228.45	1.50	215.90	187.83	116.34	532.62
7A	1			13.5	10.1	3.4	16.5	5.2	11.3	30.0	1637	314.81	23157	445.5	2.59	242.84	1.50	229.40	199.58	124.74	567.16
7B	1		Node 70	0.0	0.0	0.0	9.2	6.2	3.0	9.2	3980	638.84	27137	454.7	2.52	277.05	1.50	229.40	199.58	127.32	603.94
							225.3	129.7		454.7	27,137.0										

TRIBUTARY AREA	LENGTH (m)	GROUND ELEVATION (m)	DEPTH OF COVER (m)	PIPE SIZE (m)	INVERT 1 (m)	INVERT 2 (m)	PROPOSED SEWER PIPE TYPE	GRADE	CAPACITY (L/s)	Q(d)/Q(c)	VELOCITY at capacity (m/s)	PEAK DESIGN DEPTH (m)	PEAK DESIGN VELOCITY (m/s)
13A													
13B		95.14	5.43	0.750		88.96							
12A													
11A													
11B	531.89	93.60	4.42	0.750	88.96	88.43	Conc.	0.10%	353.24	0.81	0.80	0.53	0.90
11C													
10C	497.82	93.44	4.76	0.750	88.43	87.93	Conc.	0.10%	353.24	0.88	0.80	0.55	0.91
10B	603.17	93.03	4.95	0.750	87.93	87.33	Conc.	0.10%	353.24	0.94	0.80	0.58	0.92
10A	430.49	93.75	6.03	0.825	87.33	86.90	Conc.	0.10%	455.17	0.77	0.85	0.55	0.95
9A	1268.65	92.37	5.84	0.900	86.90	85.63	Conc.	0.10%	573.71	0.67	0.90	0.55	0.97
8A													
8B													
8C													
7A													
7B	1448.98	91.24	6.01	1.050	85.63	84.18	Conc.	0.10%	864.51	0.70	1.00	0.64	1.07
	4,781.0												

DEFAULTS

q=AVERAGE DAILY FLOW	350	L/CAP.D
I=UNIT OF PEAK EXTR.FLOW	0.280	L/Ha.s
Mannings 'n'	0.013	
q=AVERAGE COMMERCIAL AND INSTITUTIONAL	0.58	L/Ha.s

DESIGN: DJG
CHECKED:
TODAY: 7/18/2012

DILLON CONSULTING

Project 11-5681

TITLE FRAME: 709mm x 534mm City of Ottawa 2008
Novatech File No. 115075
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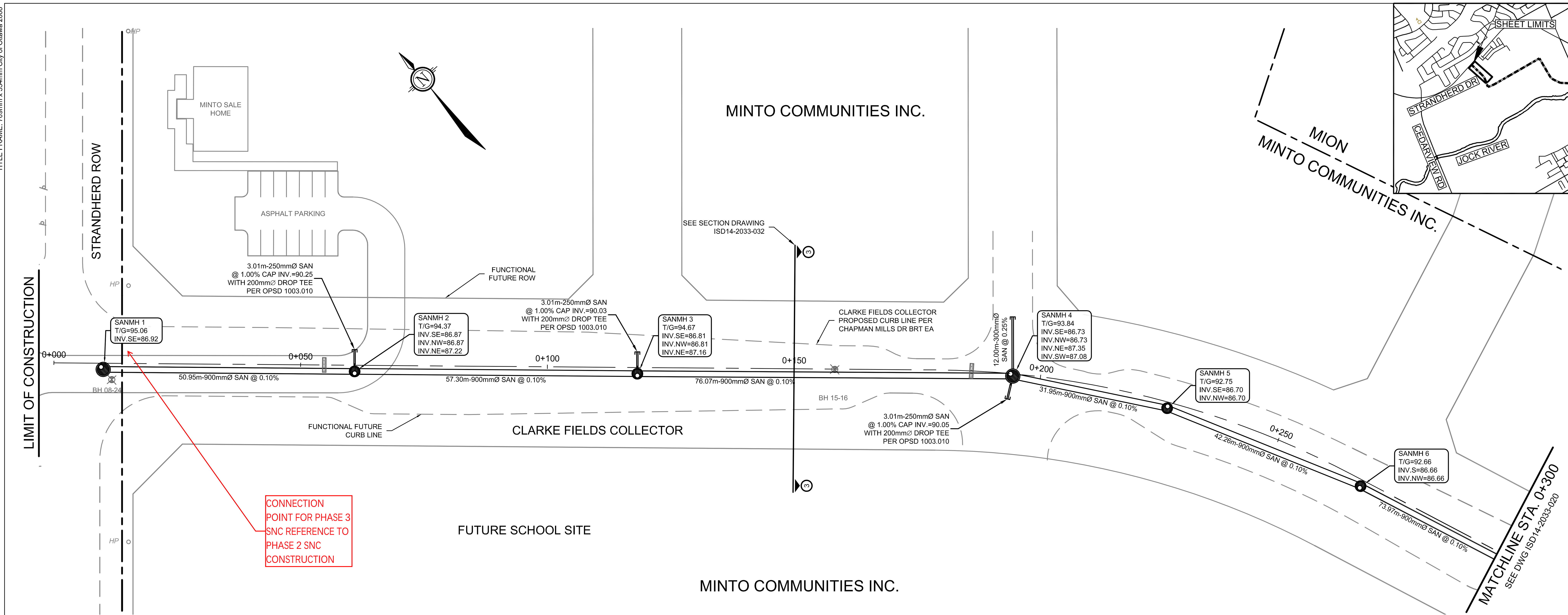

CITY OF OTTAWA

SOUTH NEPEAN COLLECTOR (SNC)
SEWER PHASE 2 - STRANDHERD DRIVE TO JOCKVALE ROAD

PLAN AND PROFILE
STA. 0+000 TO 0+300

Ottawa

Contract No. ISD14-2033 | Dwg. No. 019
Sheet 19 of 51

Asset No.
Asset Group ISD

Des.	Chk'd.
RJD	ERD
Dwn. NCS	Chk'd. RJD
Utility Circ. No.	Index No.

Const. Inspector

Scale: HORIZONTAL 1:500, VERTICAL 1:100

WAYNE NEWELL, P.Eng.
General Manager

JONATHAN KNOYLE, P.Eng.
Senior Engineer

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Kanata, Ontario, Canada, K2M 1P6
Telephone: (613) 254-9643
Facsimile: (613) 254-5867
Email: novainfo@novatech-eng.com

LICENSED PROFESSIONAL ENGINEER
M.A. BISSETT
PROVINCE OF ONTARIO

NOTE: The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

REVISIONS

No.	Description	By	Date (dd/mm/yy)
1.	ISSUED FOR PRELIMINARY DESIGN CIRCULATION	ERD	21/12/15
2.	CHANGES TO ORIENTATION ACROSS KB SWM FACILITY	ERD	16/02/16
3.	ISSUED FOR PRELIMINARY DESIGN REPORT	ERD	02/03/16
4.	ISSUED FOR FINAL DESIGN CIRCULATION	ERD	29/04/16
5.	ISSUED FOR MOECC ECA APPLICATION	ERD	26/05/16
6.	ISSUED FOR TENDER	ERD	20/06/16
7.	ISSUED FOR CONSTRUCTION	ERD	30/08/16
8.	SEWER ALIGNMENT SHIFT ON GREENBANK	ERD	16/09/16
9.	REVISED PER MION SERVICING	ERD	08/12/16

LEGEND

EXISTING ITEMS
- WATERMAIN
- WATERMAIN VALVE
- STORM SEWER
- STORM MH (STM)
- CATCH BASIN & LEAD (CB)
- CULVERT
- STORM STRUCTURE
- SANITARY SEWER
- SANITARY MH (SAN)

PROPOSED ITEMS
- SANITARY SEWER
- SANITARY MH & LID
- CULVERT
- FUTURE STRUCTURE T/G ADJUSTMENT

NOTES:

1. CONCRETE PRESSURE PIPE SHALL BE AWWA C301 (L) CL-16. FITTING SHALL BE DESIGNED TO THE SAME CRITERIA AS THE ADJACENT PIPE.
2. CONTRACTOR TO PROVIDE PIPE CLASS CALCULATIONS, AS PER AWWA C304 (DESIGN OF PRESTRESSED CONCRETE CYLINDER PIPE), BY THE PIPE MANUFACTURER, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO.
3. PIPE EMBEDMENT SHALL BE AS PER CITY OF OTTAWA DETAIL S6. SAND MAY BE USED AS PIPE COVER MATERIAL ABOVE THE SPRINGLINE.
4. A CLOTH DIAPER APPROVED BY THE PIPE MANUFACTURE SHALL BE PLACED AROUND EACH EXTERIOR JOIN RECESS AND FASTENED IN PLACE WITH EITHER WIRE OR STEEL STRAPPING STITCHED INTO ITS EDGES.
5. THE JOINT SHALL BE FILLED WITH MORTAR IN ONCE CONTINUOUS OPERATION AND PATTED OR MANIPULATED TO SETTLE THE MORTAR AND EXPEL AND ENTRAPPED AIR.
6. INTERIOR JOINTS SHALL BE FILLED WITH MORTAR AFTER BACKFILLING AND FINISHED SMOOTH WITH A TROWEL. CEMENT USED SHALL MEET THE REQUIREMENTS OF TYPE HS CEMENT (HIGH-SULPHATE-RESISTANCE), OR APPROVED EQUIVALENT.
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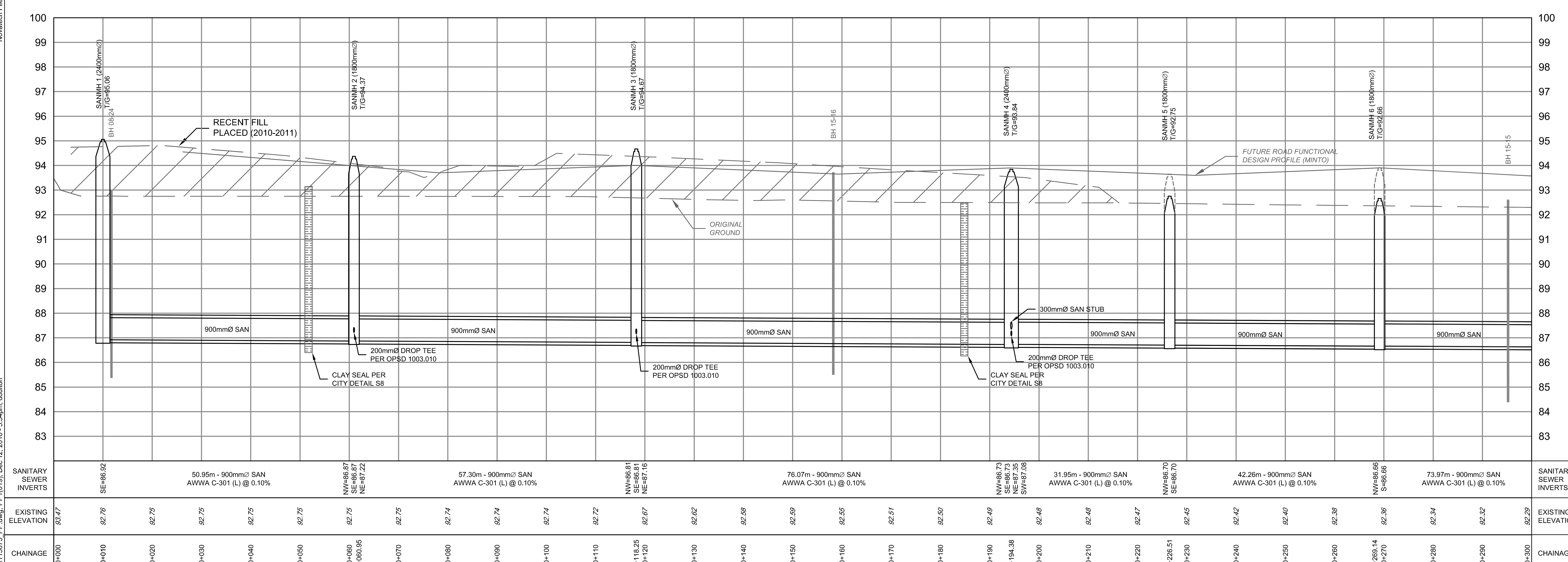
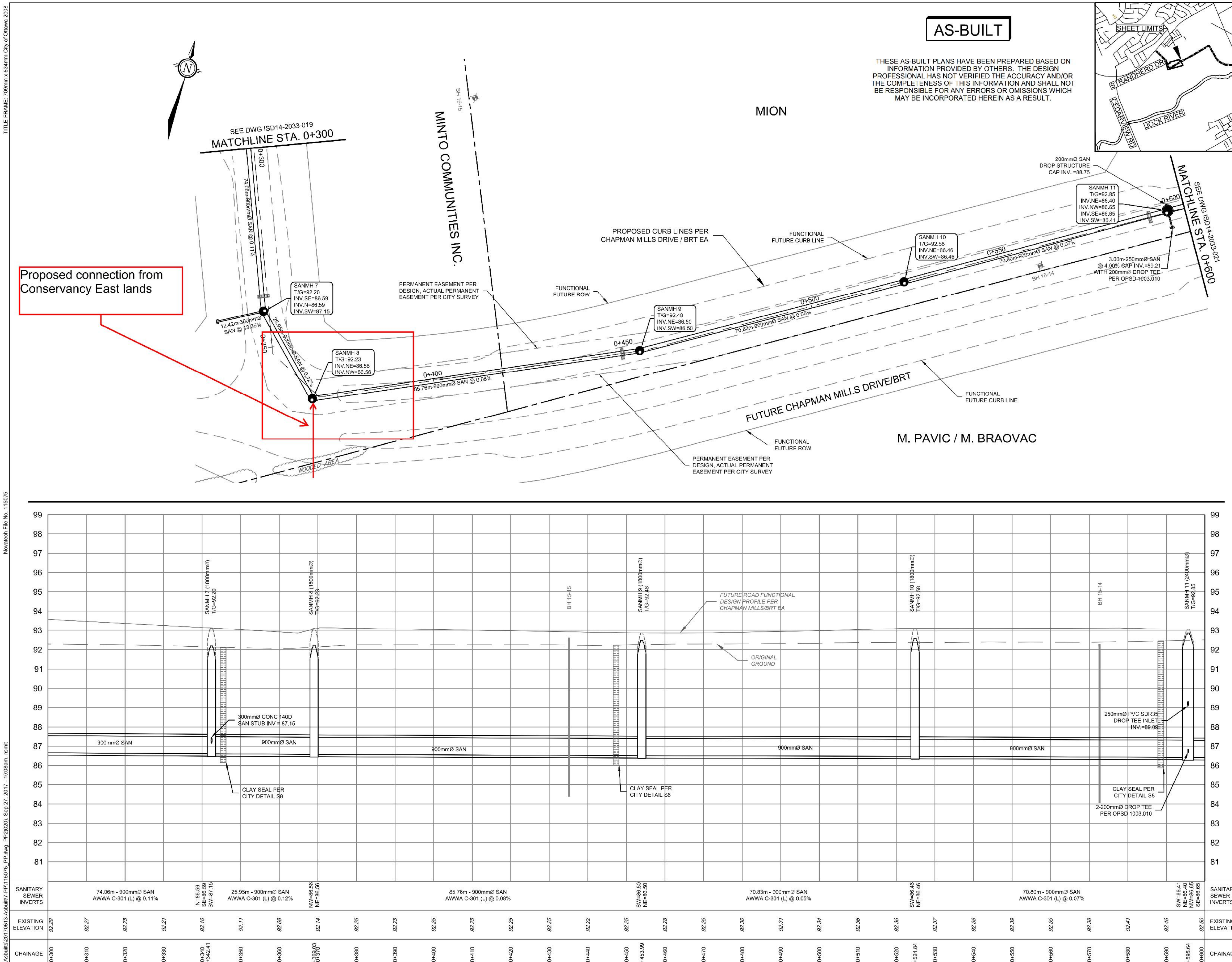
9. SEE MANHOLE DETAIL DRAWINGS ISD14-2033-36 TO ISD14-2033-45 FOR ADDITIONAL DETAILS



MAINTENANCE HOLE DATA						
MH ID	STATION	OFFSET	STRUCTURE	COVER	T/G ELEV	LOW. INV.
1	0+010.00	1.25R	OPSD 701.013	S24/S25	95.06	86.92
2	0+060.95	1.25R	OPSD 701.012	S24/S25	94.37	86.87
3	0+118.25	1.25R	OPSD 701.012	S24/S25	94.67	86.81
4	0+194.38	0.46R	OPSD 701.013	S24/S25	93.84	86.73
5	0+226.51	1.25R	OPSD 701.012	S24/S25	92.75	86.70
6	0+269.14	1.25R	OPSD 701.012	S24/S25	92.66	86.66

SANITARY SEWER PIPE DATA			
CONNECTED STRUCTURES & INVERTS	DIA (mm)	LENGTH (m)	MATERIAL
SANMH 1 = 86.92 SANMH 2 = 86.87	900	50.95	AWWA C-301 (L)
SANMH 2 = 86.87 SANMH 3 = 86.81	900	57.30	AWWA C-301 (L)
SANMH 3 = 86.81 SANMH 4 = 86.73	900	76.07	AWWA C-301 (L)
SANMH 5 = 86.70 SANMH 4 = 86.73	900	31.95	AWWA C-301 (L)
SANMH 5 = 86.70 SANMH 6 = 86.66	900	42.26	AWWA C-301 (L)
SANMH 6 = 86.66 SANMH 7 = 86.59	900	73.97	AWWA C-301 (L)



AS-BUILT

THESE AS-BUILT PLANS HAVE BEEN PREPARED BASED ON INFORMATION PROVIDED BY OTHERS. THE DESIGN PROFESSIONAL HAS NOT VERIFIED THE ACCURACY AND/OR THE COMPLETENESS OF THIS INFORMATION AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.

CITY OF OTTAWA

SOUTH NEPEAN COLLECTOR (SNC) SEWER PHASE 2 - STRANDHERD DRIVE TO JOCKVALE ROAD

PLAN AND PROFILE
STA. 0+300 TO 0+600

WAYNE NEWELL, P.Eng. – *General Manager*
JONATHAN KNOYLE, P.Eng. – *Senior Engineer*

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Ottawa

Contract No.	Dwg. No.
ISD14-2033	020

Sheet 20 of 51

Asset No.
Asset Group: ISD

Des.	Chk'd.
RJD	ERD

Dwn.	Chk'd.
NCS	RJD

Utility Circ. No.
Index No.
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7.	ISSUED FOR CONSTRUCTION	ERD	30/08/16
8.	SEWER ALIGNMENT SHIFT ON GREENBANK	ERD	16/09/16
9.	REVISED PER MION SERVICING	ERD	08/12/16
10.	MINTO LANDS MANHOLE UPDATE	ERD	24/04/17
11.	ISSUED FOR AS-BUILT	ERD	28/09/17

LEGEND

EXISTING ITEMS
- WATERMAIN
- WATERMAIN VALVE
- STORM SEWER
- STORM MH (STM)
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- CULVERT
- STORM STRUCTURE
- SANITARY SEWER
- SANITARY MH (SAN)

PROPOSED ITEMS
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MAINTENANCE HOLE DATA

MH ID	STATION	OFFSET	STRUCTURE	COVER	T/G ELEV	LOW. INV.
7	0+342.41	1.41R	OPSD 701.012	S24/S25	92.20	86.59
8	0+369.03	1.50R	OPSD 701.012	S24/S25	92.23	86.56
9	0+453.99	0.07L	OPSD 701.012	S24/S25	92.48	86.50
10	0+524.84	0.04L	OPSD 701.012	S24/S25	92.58	86.46
11	0+595.64	0.41L	OPSD 701.013	S24/S25	92.85	86.40

SANITARY SEWER PIPE DATA

CONNECTED STRUCTURES & INVERTS	DIA (mm)	LENGTH (m)	MATERIAL
SANMH 6 = 86.68 SANMH 7 = 86.59	900	74.06	AWWA C-301 (L)
SANMH 7 = 86.59 SANMH 8 = 86.56	900	25.95	AWWA C-301 (L)
SANMH 8 = 86.56 SANMH 9 = 86.50	900	85.76	AWWA C-301 (L)
SANMH 10 = 86.46 SANMH 9 = 86.50	900	70.83	AWWA C-301 (L)
SANMH 10 = 86.46 SANMH 11 = 86.41	900	70.80	AWWA C-301 (L)
SANMH 11 = 86.40 SANMH 12 = 86.32	900	78.15	AWWA C-301 (L)

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

Ottawa

LOCATION: STREET	FROM M.H.	TO M.H.	RESIDENTIAL AREA AND POPULATION: AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	COMM AREA (ha)	COMM ACCU. AREA (ha)	INSTIT AREA (ha)	INSTIT ACCU. AREA (ha)	PARK AREA (ha)	PARK ACCU. AREA (ha)	ICI Ratio	ICI Peaking Factor	I+C+I+P PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	PIPE DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
rue Moonbeam Street																															
	9A	10A	0.49	11	11		38	0.49	38	3.67	0.45										0.49	0.49	0.16	0.61	56.5	200	0.65	26.44	0.02	0.84	0.35
	10A	11A	0.38	9	9		31	0.87	69	3.63	0.81										0.38	0.87	0.29	1.10	73.0	200	1.35	38.11	0.03	1.21	0.53
To promenade Albion Falls Drive, Pipe 11A - 12A								0.87	69													0.87									
rue Douglas Fir Street																															
	7A	8A	0.73	17	17		58	0.73	58	3.64	0.68										0.73	0.73	0.24	0.93	114.0	200	0.80	29.34	0.03	0.93	0.42
To promenade Albion Falls Drive, Pipe 8A - 11A								0.73	58													0.73									
promenade Beatrice Peak Drive																															
	1A	2A	0.48	11		11	30	0.48	30	3.68	0.36										0.48	0.48	0.16	0.52	85.5	200	0.65	26.44	0.02	0.84	0.33
	2A	4A	0.40	12		12	33	0.88	63	3.63	0.74										0.40	0.88	0.29	1.03	103.5	200	0.35	19.40	0.05	0.62	0.33
To promenade Albion Falls Drive, Pipe 4A - 5A								0.88	63													0.88									
promenade Albion Falls Drive																															
	3A	4A	0.23	5	5		17	0.23	17	3.71	0.20										0.23	0.23	0.08	0.28	53.0	200	1.25	36.67	0.01	1.17	0.34
Contribution From promenade Beatrice Peak Drive, Pipe 2A - 4A								0.88	63												0.88	1.11									
	4A	5A	0.15	3	3		11	1.26	91	3.60	1.06										0.15	1.26	0.42	1.48	34.5	200	0.35	19.40	0.08	0.62	0.36
PARK	Ctrl MH 500A	5A														0.67	0.67			0.11	0.67	0.67	0.22	0.33	11.0	200	0.65	26.44	0.01	0.84	0.28
	5A	6A	0.13	2	2		7	1.39	98	3.60	1.14						0.67			0.11	0.13	2.06	0.68	1.93	14.0	200	0.35	19.40	0.10	0.62	0.39
	6A	8A	0.22	4	4		14	1.61	112	3.58	1.30						0.67			0.11	0.22	2.28	0.75	2.16	55.5	200	0.35	19.40	0.11	0.62	0.41
Contribution From rue Douglas Fir Street, Pipe 7A - 8A								0.73	58												0.73	3.01									
	8A	11A	0.22	4	4		14	2.56	184	3.53	2.10						0.67			0.11	0.22	3.23	1.07	3.28	60.0	200	0.35	19.40	0.17	0.62	0.46
Contribution From rue Moonbeam Street, Pipe 10A - 11A								0.87	69												0.87	4.10									
	11A	12A	0.15	2	2		7	3.58	260	3.48	2.94						0.67			0.11	0.15	4.25	1.40	4.45	32.5	200	0.35	19.40	0.23	0.62	0.50
	12A	24A	0.04					3.62	260	3.48	2.94						0.67			0.11	0.04	4.29	1.42	4.46	28.5	200	0.35	19.40	0.23	0.62	0.50
To croissant Point Prim Crescent, Pipe 24A - 25A								3.62	260								0.67					4.29									
voie Horseshoe Falls Way																															
	14A	18A	0.22	7		7	19	0.22	19	3.71	0.23										0.22	0.22	0.07	0.30	58.5	200	1.00	32.80	0.01	1.04	0.32
To rue Coppermine Street, Pipe 18A - 19A								0.22	19													0.22									
	18A	25A	0.22	7		7	19	0.22	19	3.71	0.23										0.22	0.22	0.07	0.30	58.0	200	0.65	26.44	0.01	0.84	0.27
To Unknown Road6 - 06, Pipe 25A - 26A								0.22	19													0.22									
rue Coppermine Street																															
Contribution From voie Horseshoe Falls Way, Pipe 14A - 18A								0.22	19												0.22	0.22									
	18A	19A	0.41	12	12		41	0.63	60	3.64	0.71										0.41	0.63	0.21	0.92	74.5	200	0.35	19.40	0.05	0.62	0.31
	19A	20A	0.38	9	9		31	1.01	91	3.60	1.06										0.38	1.01	0.33	1.40	74.5	200	0.75	28.40	0.05	0.90	0.47
To croissant Point Prim Crescent, Pipe 20A - 21A								1.01	91													1.01									
croissant Point Prim Crescent																															
	13A	14A	0.28	5	5		17	0.28	17	3.71	0.20										0.28	0.28	0.09	0.30	53.5	200	0.95	31.97	0.01	1.02	0.31
	14A	15A	0.41	11	11		38	0.69	55	3.64	0.65										0.41	0.69	0.23	0.88	69.0	200	0.95	31.97	0.03	1.02	0.43
	15A	16A	0.41	9	9		31	1.10	86	3.61	1.01										0.41	1.10	0.36	1.37	72.5	200	0.35	19.40	0.07	0.62	0.35
	16A	17A	0.13	2	2		7	1.23	93	3.60	1.09										0.13	1.23	0.41	1.49	11.0	200	0.35	19.40	0.08	0.62	0.36
	17A	20A	0.22	4	4		14	1.45	107	3.59	1.24										0.22	1.45	0.48	1.72	52.0	200	0.35	19.40	0.09	0.62	0.38
Contribution From rue Coppermine Street, Pipe 19A - 20A								1.01	91												1.01	2.46									
	20A	21A	0.06					2.52	198	3.52	2.26										0.06	2.52	0.83	3.09	35.5	200	0.35	19.40	0.16	0.62	0.45

LICENSED PROFESSIONAL ENGINEER
W. LIU
100187932
PROVINCE OF ONTARIO

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da
Average Daily Flow =	280	l/p/day
Comm/Inst Flow =	28000	L/ha/da
Industrial Flow =	35000	L/ha/da
Max Res. Peak Factor =	4.00	
Park Peak Factor =	1.50	

Industrial Peak Factor = as per MOE Graph
Extraneous Flow = 0.330 L/s/ha
Minimum Velocity = 0.600 m/s
Manning's n = (Conc) 0.013 (Pvc) 0.013
Townhouse coeff= 2.7
Single house coeff= 3.4

Designed: P.P.
Checked: W.L.
Dwg. Reference: Sanitary Drainage Plan, Dwg. No. 33

PROJECT: **BARRHAVEN CONSERVANCY PHASE 1**
LOCATION: **City of Ottawa**
File Ref: 16-891
Date: January, 2019
Sheet No. 1 of 2

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INSTIT		PARK				I+C+I+P	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	ICI Ratio	ICI Peaking Factor	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
	21A	22A	0.04					2.56	198	3.52	2.26										0.04	2.56	0.84	3.10	21.0	200	0.35	19.40	0.16	0.62	0.45
	22A	23A	0.01					2.57	198	3.52	2.26										0.01	2.57	0.85	3.11	8.0	200	0.35	19.40	0.16	0.62	0.45
	23A	24A	0.26	6	6		21	2.83	219	3.51	2.49										0.26	2.83	0.93	3.42	42.0	200	0.80	29.34	0.12	0.93	0.62
Contribution From promenade Albion Falls Drive, Pipe 12A - 24A								3.62	260								0.67				4.29	7.12									
	24A	25A	0.49	12	12		41	6.94	520	3.37	5.68						0.67			0.11	0.49	7.61	2.51	8.30	91.5	200	0.35	19.40	0.43	0.62	0.59
Contribution From voie Horseshoe Falls Way, Pipe 18A - 25A								0.22	19												0.22	7.83									
Upper Pipe	26A	25A	0.30	5	5		17														0.30	0.30	0.10	0.10	66.5	200	0.65	26.44	0.00	0.84	0.19
Lower Pipe	25A	26A						7.46	556	3.36	6.05						0.67			0.11	0.00	8.13	2.68	8.85	66.5	200	0.35	19.40	0.46	0.62	0.60
To promenade Chapman Mills Drive, Pipe 26A - Ex. MH 13								7.46	556								0.67					8.13									
promenade Chapman Mills Drive																															
	28A	29A	0.41	7		7	19	0.41	19	3.71	0.23										0.41	0.41	0.14	0.36	42.0	200	0.65	26.44	0.01	0.84	0.29
	29A	30A	0.28	6		6	17	0.69	36	3.67	0.43										0.28	0.69	0.23	0.66	60.0	200	0.35	19.40	0.03	0.62	0.29
	30A	31A	0.44	9		9	25	1.13	61	3.64	0.72										0.44	1.13	0.37	1.09	120.0	200	0.35	19.40	0.06	0.62	0.33
	31A	*Ex. MH 11*						1.13	61	3.64	0.72										0.00	1.13	0.37	1.09	18.5	200	3.40	60.48	0.02	1.93	0.72
To Existing Sanitary Trunk, *Ex. Pipe 11 - 12*								1.13	61													1.13									
	27A	26A	0.50	14		14	38	0.50	38	3.67	0.45						0.00			0.00	0.50	0.50	0.17	0.62	98.0	200	0.65	26.44	0.02	0.84	0.35
Contribution From croissant Point Prim Crescent, Pipe 25A - 26A								7.46	556								0.67				8.13	8.13									
	26A	*Ex. MH 13*						7.96	594	3.35	6.44						0.67			0.11	0.00	8.63	2.85	9.40	23.5	200	0.35	19.40	0.48	0.62	0.61
To Existing Sanitary Trunk, *Ex. Pipe 13 - 14*								7.96	594								0.67					8.63									

Conservancy Phase 1 - Flows and population tributary to South Nepean Collector

LICENSED PROFESSIONAL ENGINEER
W. LIU
100167932
PROVINCE OF ONTARIO

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da
Average Daily Flow =	280	l/p/day
Comm/Inst Flow =	28000	L/ha/da
Industrial Flow =	35000	L/ha/da
Max Res. Peak Factor =	4.00	
Park Peak Factor =	1.50	

Industrial Peak Factor = as per MOE Graph
Extraneous Flow = 0.330 L/s/ha
Minimum Velocity = 0.600 m/s
Manning's n = (Conc) 0.013 (Pvc) 0.013
Townhouse coeff= 2.7
Single house coeff= 3.4

Designed: P.P.		PROJECT: BARRHAVEN CONSERVANCY PHASE 1	
Checked: W.L.		LOCATION: City of Ottawa	
Dwg. Reference: Sanitary Drainage Plan, Dwg. No: 33	File Ref: 16-891	Date: January, 2019	Sheet No. 2 of 2

891_San3.xlsx

SANITARY SEWER CALCULATION SHEET

104 people/Ha	Population Density (Conservancy West)
83 people/Ha	Population Density (Conservancy East)

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION						COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
										0.00				0.00	0.00	0.00	0.00	0.000	0.00							
Extracted from SNC Novatech Ph3 design		EX SANMH1[(1)]	105.8	10974	105.8	10974.0	2.53	89.98	179.17	179.17	17.25	17.25		0.00	92.69	302.22	302.22	99.73	282.40	165.0	914.4	0.10	597.22	0.47	0.91	0.89
at Strandherd & CMD intersection		See Note [(2)]	31.5	3116	137.3	14090	2.44	111.42		179.17				0.00	87.10	31.50	333.7	110.12	308.64	50.0	914.4	0.10	597.22	0.52	0.91	0.91
CONSERVANCY WEST [(3)]		EX SANMH8	38.4	3913	175.7	18003	2.36	137.69		179.17				0.00	87.10	38.40	372.10	122.79	347.58	125.0	914.4	0.10	597.22	0.58	0.91	0.94
CONSERVANCY EAST [(3)]		EX SANMH8	61.7	4839	237.4	22842	2.28	168.78		179.17				0.00	87.10	61.70	433.80	143.15	399.03	260.0	914.4	0.10	597.22	0.67	0.91	0.97
					237.4	22842	2.28	168.78		179.17				0.00	87.10	0.00	433.80	143.15	399.03		914.4	0.10	597.22	0.67	0.91	0.97

NOTES:

(1) Refer to Novatech Drawing No. 19 - South Nepean Collector (SNC) Sewer Phase 2 - Strandherd Rive to Jockvale Road (ISD14-2033) in Appendix C

(2) Derived from Tributary areas "A6-C" and "A6-D" from Novatech's "Sanitary Drainage Areas and Land Use - Fig. 1" plan dated August 2015 (See Appendix C of DSEL report) = 4.87ha and 17.56ha and derived from Barrhaven Conservancy Phase 1 design sheet (see Appendix C of DSEL report) = 1.13ha + 7.96ha

(3) Based on population densities of 104 people/ha for WEST and 83 people/ha for EAST. See Conservancy East sanitary design sheet

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da			
Average Daily Flow =	280	l/p/day	Industrial Peak Factor = as per MOE Graph		
Comm/Inst Flow =	28000	L/ha/da	Extraneous Flow =	0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	Minimum Velocity =	0.600	m/s
Max Res. Peak Factor =	4.00		Manning's n =	0.000	
Commercial/Inst./Park Peak Factor =	1.50		Townhouse coeff=	2.7	
Institutional	0.32	l/s/Ha	Single house coeff=	3.4	

Designed: KLM	PROJECT: **Barrhaven Conservancy - Evaluation of SNC Flows**		
Checked: KLM	LOCATION: **City of Ottawa**		
Dwg. Reference:	File Ref: 16-891	Date: June 2020	Sheet No. 1 of 1

TOTAL FLOW INCLUDING CONSERVANCY LANDS IS 399.03 L/S WHICH IS LESS THAN THE PRIOR 423.6 L/S DETERMINED IN THE 2015 NOVATECH ASSESSMENT OF FLOWS AT THE SAME LOCATION IN THE SOUTH NEPEAN COLLECTOR DESIGN.

SANITARY SEWER CALCULATION SHEET

Ottawa

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	PPHA*	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
SANITARY TRUNK 1																											
Contribution From Barrhaven Conservancy West:						38.41	3913				0.00		0.00		0.00		0.00	38.41									
	1122A	1124A	0.63	83	53	39.04	3966	2.9	36.88		0.00		0.00		0.00	0.00	0.63	39.04	12.88	49.76	58.5	450	0.15	110.42	0.45	0.69	0.68
	1124A	1134A	0.63	83	53	39.67	4019	2.9	37.31		0.00		0.00		0.00	0.00	0.63	39.67	13.09	50.41	16.5	450	0.15	110.42	0.46	0.69	0.68
	1134A	1135A	2.73	83	227	42.40	4246	2.8	39.19		0.00		0.00		0.00	0.00	2.73	42.40	13.99	53.18	42.0	525	0.10	136.00	0.39	0.63	0.59
	1135A	1141A	0.70	83	59	43.10	4305	2.8	39.67		0.00		0.00		0.00	0.00	0.70	43.10	14.22	53.89	58.5	525	0.10	136.00	0.40	0.63	0.59
	1141A	1144A	1.06	83	88	44.16	4393	2.8	40.39		0.00		0.00		0.00	0.00	1.06	44.16	14.57	54.96	58.5	525	0.10	136.00	0.40	0.63	0.59
	1144A	1174A	0.85	83	71	45.01	4464	2.8	40.97		0.00		0.00		0.00	0.00	0.85	45.01	14.85	55.82	58.5	525	0.10	136.00	0.41	0.63	0.60
			0.03	83	3	45.04	4467				0.00		0.00		0.00		0.03	45.04									
	1174A	1175A	4.94	83	411	49.98	4878	2.8	44.32		0.00		0.00		0.00	0.00	4.94	49.98	16.49	60.82	69.5	525	0.10	136.00	0.45	0.63	0.61
From External			4.21	85	358	54.19	5236				0.00		0.00	0.93	0.93		5.14	55.12									
			0.97	83	81	55.16	5317				0.00		0.00		0.93		0.97	56.09									
			1.43	83	119	56.59	5436				0.00		0.00		0.93		1.43	57.52									
			1.65	83	137	58.24	5573				0.00		0.00		0.93		1.65	59.17									
	1175A	1186A	0.44	83	37	58.68	5610	2.8	50.15		0.00		0.00		0.93	0.10	0.44	59.61	19.67	69.92	87.5	525	0.10	136.00	0.51	0.63	0.63
	1186A	1190A	2.31	83	192	60.99	5802	2.7	51.66		0.00		0.00		0.93	0.10	2.31	61.92	20.43	72.19	58.5	525	0.10	136.00	0.53	0.63	0.64
	1190A	1200A	2.29	83	191	63.28	5993	2.7	53.15		0.00		0.00		0.93	0.10	2.29	64.21	21.19	74.44	59.0	525	0.10	136.00	0.55	0.63	0.64
	1200A	1201A	3.69	83	307	66.97	6300	2.7	55.54		0.00		0.00	0.85	1.78	0.19	4.54	68.75	22.69	78.42	79.5	525	0.10	136.00	0.58	0.63	0.65
	1201A	1204A	0.50	83	42	67.47	6342	2.7	55.86		0.00		0.00		1.78	0.19	0.50	69.25	22.85	78.91	79.5	525	0.10	136.00	0.58	0.63	0.65
	1204A	1223A	1.26	83	105	68.73	6447	2.7	56.67		0.00		0.00		1.78	0.19	1.26	70.51	23.27	80.13	58.5	525	0.10	136.00	0.59	0.63	0.65
	1223A	1228A	5.84	83	485	74.57	6932	2.7	60.39		0.00		0.00	0.43	2.21	0.24	6.27	76.78	25.34	85.97	58.5	525	0.10	136.00	0.63	0.63	0.66
	1228A	1237A	1.78	83	148	76.35	7080	2.7	61.52		0.00		0.00		2.21	0.24	1.78	78.56	25.92	87.68	58.5	525	0.10	136.00	0.64	0.63	0.67
	1237A	1249A	3.36	83	279	79.71	7359	2.7	63.64		0.00		0.00		2.21	0.24	3.36	81.92	27.03	90.91	58.5	525	0.10	136.00	0.67	0.63	0.67
	1249A	1250A	3.08	83	256	82.79	7615	2.7	65.56		0.00		0.00	0.67	2.88	0.31	3.75	85.67	28.27	94.15	98.5	525	0.10	136.00	0.69	0.63	0.68
	1250A	1272A				82.79	7615	2.7	65.56		0.00		0.00		2.88	0.31	0.00	85.67	28.27	94.15	98.5	525	0.10	136.00	0.69	0.63	0.68
	1272A	1278A	5.86	83	487	88.65	8102	2.6	69.21		0.00		0.00		2.88	0.31	5.86	91.53	30.20	99.72	25.5	525	0.10	136.00	0.73	0.63	0.69
	1278A	1281A				88.65	8102	2.6	69.21		0.00		0.00		2.88	0.31	0.00	91.53	30.20	99.72	58.5	525	0.10	136.00	0.73	0.63	0.69
	1281A	1297A				88.65	8102	2.6	69.21		0.00		0.00		2.88	0.31	0.00	91.53	30.20	99.72	91.5	525	0.10	136.00	0.73	0.63	0.69
	1297A	1298A	7.70	83	640	96.35	8742	2.6	73.94		0.00		0.00	0.76	3.64	0.39	8.46	99.99	33.00	107.33	14.5	525	0.15	166.56	0.64	0.77	0.82
	1298A	1299A	0.12	83	10	96.47	8752	2.6	74.01		0.00		0.00		3.64	0.39	0.12	100.11	33.04	107.44	79.0	525	0.15	166.56	0.65	0.77	0.82
	1299A	1300A				96.47	8752	2.6	74.01		0.00		0.00		3.64	0.39	0.00	100.11	33.04	107.44	79.0	525	0.15	166.56	0.65	0.77	0.82
To Existing Sanitary Trunk:						96.47	8752				0.00		0.00		3.64			100.11									

* PPHA calculated based on a weighted average across the site, using the single house and townhouse coefficents of 3.4 and 2.7 people per unit respectively

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha	
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow = 0.330 L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity = 0.600 m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc) 0.013 (Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff= 2.7
Institutional =	0.32	l/s/Ha			Single house coeff= 3.4

Designed: R.B.

Checked: D.A.

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 4

PROJECT: **BARRHAVEN CONSERVANCY EAST**

LOCATION: **City of Ottawa**

File Ref: 16-891

Date: July 2020

Sheet No. 1 of 1

891_SAN_Trunk.xlsx

APPENDIX D

STORMWATER

May 31, 2020

City of Ottawa
110 Laurier Avenue,
Ottawa, ON K1P 1J1

Attention: Doug James

Subject: **Barrhaven Conservancy Development Corporation**
Status of As-Built Grading
Related: RVCA Permit # RV5-4419 and RV5-1718)
Vacant land on the north side of the Jock River generally bounded by Highway 416 and the Fraser Clarke Creek, City of Ottawa

Dear Mr. James:

The RVCA has reviewed information recently submitted by David Schaeffer Engineering Ltd. including as-built grades in support of works approved by the Rideau Valley Conservation Authority under Section 28 of the Conservation Authorities Act (Permit File Number: RV5-4419 and RV5-1718). The RVCA offers the following comments related to future development proposed for the area within the scope of approved the permits.

The subject lands as identified as part of Lots 11, 12, 13, 14, 15 former geographic Township of Nepean, Concessions 3 & 4, now in the City of Ottawa have been addressed through the general placement of fill and the formal construction of a berm around the perimeter of four blocks within the subject lands. The site specific elevations of the berm have been reviewed by the RVCA and are generally accepted as being appropriate as removing these lands from the floodplain in accordance with the aforementioned approved permits.

The detailed grading plans submitted by David Schaeffer Engineering Ltd. titled As Constructed plan of Berms and Cut Areas – Barrhaven Conservancy", dated May 27, 2020, prepared by Adam Fobert, P.Eng. of DSEL, DSEL File Number 16891 using the following resources:

- Orthoimagery Survey, dated April 20, 2020, acquired and processed by First Base Solutions a division of JD Barnes Ltd and certified by Chris Fox, O.L.S., A.L.S., P. Eng. of JD Barnes Ltd, file reference number 2037OTTA0001;
- Topographic Detail of Part of Lot 13, 14,&15 Concession 3&4, dated May 6, 2020, certified by Chris Fox, O.L.S., A.L.S., P. Eng. of JD Barnes Ltd, file reference number 16-10-127-00;

- Contractor as-built collected by the Tomlinson Group of Companies of Phase 1 dated May 15, 2020, reviewed by Jeremy Chouindard, EIT and certified by Stephen Pichette, P.Eng. of DSEL

The above information indicates that land within the berm have generally been raised to exceed the flood elevation cross sections throughout the project area. However, it is noted that as this is considered an active construction site the presence of lower areas to manage construction, on-site erosion and sediment control show lower elevations. These areas will be addressed through the construction process, as sufficient material is presently stockpiled for this purpose to ensure. For the purposes of the floodplain, these areas are considered removed by virtue of the berm.

Conclusion:

The grade modifications, including construction of the berm and filling behind the berm, as documented in the above noted "as constructed" plans, have been completed in accordance with the plans approved by the RVCA under permits RV5-4419 and RV5-1718.

Please feel free to contact our office with any questions or comments you may have.

Respectfully,

Terry K. Davidson

Terry Davidson, P.Eng
Director of Engineering and Regulations
Rideau Valley Conservation Authority
613-692-3571 x1107
terry.davidson@rvca.ca

attach: Technical memorandum by Evelyn Liu, M.Asc., P.Eng. Water Resources Engineer, RVCA dated May 29, 2020

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

	LOCATION		AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
TRUNK 10																																	
			0.79	0.65	1.43	1.43			0.00	0.00			0.00	0.00			0.00	0.00	11.81														
	3304	3305			0.00	1.43			0.00	0.00			0.00	0.00			0.00	0.00	11.81	70.49	95.51	111.92	163.55	101	450	450	CONC	0.20	71.0	127.5033	0.8017	1.4760	0.789
	3305	3310	0.38	0.65	0.69	2.11			0.00	0.00			0.00	0.00			0.00	0.00	13.29	66.13	89.54	104.89	153.22	140	600	600	CONC	0.15	71.0	237.8056	0.8411	1.4069	0.588
			1.37	0.65	2.48	4.59			0.00	0.00			0.00	0.00			0.00	0.00	13.25														
	3310	3311			0.00	4.59			0.00	0.00			0.00	0.00			0.00	0.00	14.69	62.50	84.56	99.03	144.63	287	675	675	CONC	0.20	68.5	375.9224	1.0505	1.0868	0.763
	3311	3313			0.00	4.59	0.07	0.65	0.13	0.13			0.00	0.00			0.00	0.00	15.78	59.99	81.12	94.99	138.69	286	750	750	CONC	0.15	11.0	431.1703	0.9760	0.1878	0.662
			0.49	0.65	0.89	5.48			0.00	0.13			0.00	0.00			0.00	0.00	11.00														
			0.17	0.65	0.31	5.78			0.00	0.13			0.00	0.00			0.00	0.00															
	3313	3314			0.00	5.78	0.24	0.65	0.43	0.56			0.00	0.00			0.00	0.00	15.97	59.57	80.56	94.32	137.72	390	825	825	CONC	0.15	94.5	555.9418	1.0400	1.5144	0.701
	3314	3318	0.05	0.65	0.09	5.87			0.00	0.56			0.00	0.00			0.00	0.00	17.48	56.47	76.31	89.33	130.39	374	825	825	CONC	0.10	13.0	453.9246	0.8492	0.2552	0.825
			0.36	0.65	0.65	6.52			0.00	0.56			0.00	0.00			0.00	0.00	12.53														
	3318	OGS 10			0.00	6.52			0.00	0.56			0.00	0.00			0.00	0.00	17.74	55.98	75.64	88.55	129.24	408	825	825	CONC	0.15	5.0	555.9418	1.0400	0.0801	0.733
TRUNK 9																																	
			0.81	0.65	1.46	1.46			0.00	0.00			0.00	0.00			0.00	0.00	12.00														
	3205	3207			0.00	1.46			0.00	0.00			0.00	0.00			0.00	0.00	12.00	69.89	94.70	110.96	162.13	102	450	450	CONC	0.20	58.5	127.5033	0.8017	1.2162	0.802
			0.39	0.65	0.70	2.17			0.00	0.00			0.00	0.00			0.00	0.00	10.72														
	3207	3209			0.00	2.17			0.00	0.00			0.00	0.00			0.00	0.00	13.22	66.33	89.80	105.20	153.68	144	525	525	CONC	0.20	64.5	192.3297	0.8885	1.2100	0.748
			0.23	0.65	0.42	2.58			0.00	0.00			0.00	0.00			0.00	0.00	10.68														
	3209	3213			0.00	2.58			0.00	0.00			0.00	0.00			0.00	0.00	14.43	63.16	85.46	100.09	146.18	163	525	525	CONC	0.20	16.0	192.3297	0.8885	0.3001	0.849
			0.95	0.65	1.72	4.30			0.00	0.00			0.00	0.00			0.00	0.00	13.51														
	3213	3215			0.00	4.30			0.00	0.00			0.00	0.00			0.00	0.00	14.73	62.42	84.45	98.90	144.44	268	675	675	CONC	0.15	62.5	325.5584	0.9098	1.1450	0.825
			0.45	0.65	0.81	5.11			0.00	0.00			0.00	0.00			0.00	0.00	10.58														
			0.07	0.65	0.13	5.24			0.00	0.00			0.00	0.00			0.00	0.00															
	3215	3216			0.00	5.24	0.07	0.65	0.13	0.13			0.00	0.00			0.00	0.00	15.87	59.78	80.84	94.66	138.21	324	750	750	CONC	0.15	87.5	431.1703	0.9760	1.4942	0.750
	3216	3217	0.11	0.65	0.20	5.44			0.00	0.13			0.00	0.00			0.00	0.00	17.37	56.70	76.62	89.69	130.93	318	750	750	CONC	0.15	11.5	431.1703	0.9760	0.1964	0.738
	3217	3222	0.16	0.65	0.29	5.73			0.00	0.13			0.00	0.00			0.00	0.00	17.56	56.32	76.10	89.08	130.03	332	750	750	CONC	0.15	50.0	431.1703	0.9760	0.8539	0.770
			0.51	0.65	0.92	6.65			0.00	0.13			0.00	0.00			0.00	0.00	13.07														
			0.20	0.65	0.36	7.01			0.00	0.13			0.00	0.00			0.00	0.00															
	3222	OGS 9			0.00	7.01	0.21	0.65	0.38	0.51			0.00	0.00			0.00	0.00	18.42	54.73	73.93	86.54	126.29	421	825	825	CONC	0.15	5.5	555.9418	1.0400	0.0881	0.757
TRUNK 8																																	
			1.03	0.80	2.29	2.29			0.00	0.00			0.00	0.00			0.00	0.00	13.09														
	3105	3106	0.06	0.80	0.13	2.42			0.00	0.00			0.00	0.00			0.00	0.00	13.09	66.68	90.28	105.76	154.51	162	600	600	CONC	0.15	41.0	237.8056	0.8411	0.8125	0.680
	3106	3107	0.27	0.80	0.60	3.02			0.00	0.00			0.00	0.00			0.00	0.00	13.90	64.49	87.28	102.23	149.32	195	600	600	CONC	0.15	71.0	237.8056	0.8411	1.4069	0.820
	3107	3109	0.33	0.80	0.73	3.76			0.00	0.00			0.00	0.00			0.00	0.00	15.31	61.05	82.57	96.69	141.19	229	600	600	CONC	0.20	71.0	274.5943	0.9712	1.2185	0.836
			0.05	0.80	0.11	3.87			0.00	0.00			0.00	0.00			0.00	0.00	10.41														
	3109	3117			0.00	3.87			0.00	0.00			0.00	0.00			0.00	0.00	16.53	58.38	78.93	92.41	134.90	226	675	675	CONC	0.15	33.5	325.5584	0.9098	0.6137	0.694
			0.36	0.80	0.80	4.67			0.00	0.00			0.00	0.00			0.00	0.00	13.79														
			0.04	0.65	0.07	4.74			0.00	0.00			0.00	0.00			0.00	0.00															
	3117	3119	1.07	0.65	1.93	6.68			0.00	0.00			0.00	0.00			0.00	0.00	17.14	57.14	77.22	90.40	131.96	381	750	750	CONC	0.20	43.5	497.8726	1.1270	0.6433	0.766
					0.00	6.68	0.15	0.65	0.27	0.27			0.00	0.00			0.00	0.00	11.06														
			0.05	0.80	0.11	6.79			0.00	0.27			0.00	0.00			0.00	0.00															
			0.10	0.65	0.18	6.97			0.00	0.27			0.00	0.00			0.00	0.00															
	3119	3121	0.05	0.80	0.11	7.08			0.00	0.27			0.00	0.00			0.00	0.00	17.78	55.89	75.52	88.40	129.03	416	750	750	CONC	0.20	37.5	497.8726	1.1270	0.5546	0.836
			0.11	0.80	0.24	7.32			0.00	0.27			0.00	0.00			0.00	0.00	11.09														
			0.27	0.65	0.49	7.81			0.00	0.27			0.00	0.00			0.00	0.00															
	3121	3125	0.30	0.80	0.67	8.48			0.00	0.27			0.00	0.00			0.00	0.00	18.34	54.87	74.12	86.76	126.62	485	750	750	CONC	0.20	62.5	497.8726	1.1270	0.9243	0.975
			0.24	0.65	0.43	8.91			0.00	0.27			0.00	0.00			0.00	0.00	11.74														
	3125	3129	0.30	0.80	0.67	9.58			0.00	0.27			0.00	0.00			0.00	0.00	19.26	53.25	71.91	84.16	122.81	530	825	825	CONC	0.20	52.5	641.9463	1.2009	0.7286	0.825
			0.59	0.65	1.07	10.65			0.00	0.27			0.00	0.00			0.00	0.00	12.57														
			0.16	0.65	0.29	10.94			0.00	0.27			0.00	0.00			0.00	0.00															
	3129	3131			0.00	10.94	0.19	0.65	0.34	0.61			0.00	0.00			0.00	0.00	19.99	52.04	70.27	82.23	119.98	612	900	900	CONC	0.15	22.5	701.1305	1.1021	0.3403	0.873
	3131	OGS 8	0.93	0.40	1.03	11.97			0.00	0.61			0.00	0.00			0.00	0.00	20.33	51.50	69.53	81.36	118.71	659	900	900	CONC	0.20	42.5	809.5958	1.2726	0.5566	0.814

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: R.B	PROJECT: BARRHAVEN COSERVANCY EAST		
Checked: D.A.	LOCATION: City of Ottawa		
Dwg. Reference: 3	File Ref: 16-891	Date: Ju\lye 2020	Sheet No. SHEET 1 OF 4

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Manning 0.013

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
TRUNK 7A																																	
			1.19	0.65	2.15	2.15			0.00	0.00			0.00	0.00			0.00	0.00	16.89														
					0.00	2.15	0.06	0.65	0.11	0.11			0.00	0.00			0.00	0.00															
			0.05	0.65	0.09	2.24			0.00	0.11			0.00	0.00			0.00	0.00															
	6205	6224	0.81	0.65	1.46	3.70			0.00	0.11			0.00	0.00			0.00	0.00	16.89	57.64	77.91	91.21	133.15	222	675	675	CONC	0.15	60.5	325.5584	0.9098	1.1083	0.682
To TRUNK 7, Pipe 6224 - OGS 7						3.70				0.11				0.00				0.00	18.00														
					0.00	0.00			0.00	0.00	3.98	0.80	8.85	8.85			0.00	0.00	17.54														
	6150	6151			0.00	0.00			0.00	0.00			0.00	8.85			0.00	0.00	17.54	56.36	76.16	89.15	130.13	789	1050	1050	CONC	0.15	26.5	1057.6053	1.2214	0.3616	0.746
	6151	6224			0.00	0.00			0.00	0.00			0.00	8.85			0.00	0.00	17.90	55.67	75.22	88.05	128.51	779	1050	1050	CONC	0.15	64.0	1057.6053	1.2214	0.8733	0.737
To TRUNK 7, Pipe 6224 - OGS 7						0.00				0.00				8.85				0.00	18.77														
TRUNK 7																																	
			0.39	0.65	0.70	0.70			0.00	0.00			0.00	0.00			0.00	0.00	12.58														
	6210	6213	0.70	0.80	1.56	2.26			0.00	0.00			0.00	0.00			0.00	0.00	12.58	68.14	92.29	108.13	157.97	154	525	525	CONC	0.20	43.5	192.3297	0.8885	0.8160	0.801
			0.05	0.80	0.11	2.37			0.00	0.00			0.00	0.00			0.00	0.00															
					0.00	2.37	0.41	0.65	0.74	0.74			0.00	0.00			0.00	0.00	11.13														
			0.04	0.80	0.09	2.46			0.00	0.74			0.00	0.00			0.00	0.00															
			0.03	0.80	0.07	2.53			0.00	0.74			0.00	0.00			0.00	0.00															
	6213	6216	0.05	0.80	0.11	2.64			0.00	0.74			0.00	0.00			0.00	0.00	13.40	65.83	89.12	104.40	152.51	240	600	600	CONC	0.30	31.5	336.3080	1.1894	0.4414	0.713
			0.13	0.80	0.29	2.93			0.00	0.74			0.00	0.00			0.00	0.00	11.15														
			0.10	0.80	0.22	3.15			0.00	0.74			0.00	0.00			0.00	0.00															
			0.09	0.80	0.20	3.35			0.00	0.74			0.00	0.00			0.00	0.00															
	6216	6217	0.29	0.65	0.52	3.88			0.00	0.74			0.00	0.00			0.00	0.00	13.84	64.65	87.51	102.50	149.72	315	750	750	CONC	0.15	76.0	431.1703	0.9760	1.2979	0.731
			0.13	0.80	0.29	4.16			0.00	0.74			0.00	0.00			0.00	0.00															
	6217	6222	0.23	0.65	0.42	4.58			0.00	0.74			0.00	0.00			0.00	0.00	15.14	61.45	83.12	97.34	142.14	343	750	750	CONC	0.15	76.0	431.1703	0.9760	1.2979	0.796
			0.18	0.65	0.33	4.91			0.00	0.74			0.00	0.00			0.00	0.00	13.44														
			0.55	0.80	1.22	6.13			0.00	0.74			0.00	0.00			0.00	0.00															
	6222	6223	0.10	0.65	0.18	6.31			0.00	0.74			0.00	0.00			0.00	0.00	16.43	58.58	79.20	92.72	135.37	428	750	750	CONC	0.30	27.0	609.7669	1.3802	0.3260	0.702
	6223	6224	0.02	0.65	0.04	6.35			0.00	0.74			0.00	0.00			0.00	0.00	16.76	57.91	78.27	91.64	133.78	425	750	750	CONC	0.30	10.5	609.7669	1.3802	0.1268	0.698
Contribution From TRUNK 7A, Pipe 6151 - 6224						0.00				0.00				8.85				0.00	18.77														
Contribution From TRUNK 7A, Pipe 6205 - 6224						3.70				0.11				0.00				0.00	18.00														
	6224	OGS 7			0.00	10.05			0.00	0.85			0.00	8.85			0.00	0.00	18.77	54.09	73.06	85.51	124.79	1363	1200	1200	CONC	0.20	3.5	1743.5652	1.5417	0.0378	0.781
TRUNK 6																																	
			0.92	0.65	1.66	1.66			0.00	0.00			0.00	0.00			0.00	0.00	12.35														
	6303	6305			0.00	1.66			0.00	0.00			0.00	0.00			0.00	0.00	12.35	68.82	93.23	109.23	159.59	114	450	450	CONC	0.25	47.0	142.5531	0.8963	0.8739	0.803
			0.85	0.65	1.54	3.20			0.00	0.00			0.00	0.00			0.00	0.00	12.35														
	6305	6307			0.00	3.20			0.00	0.00			0.00	0.00			0.00	0.00	13.22	66.30	89.77	105.16	153.62	212	675	675	CONC	0.15	69.0	325.5584	0.9098	1.2641	0.651
			0.55	0.65	0.99	4.19			0.00	0.00			0.00	0.00			0.00	0.00	12.20														
	6307	6309			0.00	4.19	0.39	0.65	0.70	0.70			0.00	0.00			0.00	0.00	14.49	63.00	85.25	99.84	145.81	324	675	675	CONC	0.25	31.5	420.2941	1.1745	0.4470	0.771
			0.19	0.65	0.34	4.54			0.00	0.70			0.00	0.00			0.00	0.00	10.86														
	6309	6312			0.00	4.54			0.00	0.70			0.00	0.00			0.00	0.00	14.93	61.92	83.77	98.10	143.26	340	675	675	CONC	0.25	25.5	420.2941	1.1745	0.3619	0.809
			0.87	0.65	1.57	6.11			0.00	0.70			0.00	0.00			0.00	0.00	12.42														
	6312	6316			0.00	6.11			0.00	0.70			0.00	0.00			0.00	0.00	15.30	61.08	82.61	96.74	141.26	431	750	750	CONC	0.25	59.0	556.6385	1.2600	0.7804	0.775
			0.99	0.65	1.79	7.90			0.00	0.70			0.00	0.00			0.00	0.00	12.55														
	6316	6317			0.00	7.90			0.00	0.70			0.00	0.00			0.00	0.00	16.08	59.34	80.23	93.94	137.15	525	825	825	CONC	0.20	66.5	641.9463	1.2009	0.9229	0.818
			0.22	0.65	0.40	8.29			0.00	0.70			0.00	0.00			0.00	0.00															
	6317	6318	0.85	0.40	0.95	9.24			0.00	0.70			0.00	0.00			0.00	0.00	17.00	57.42	77.61	90.85	132.63	585	900	900	CONC	0.15	67.0	701.1305	1.1021	1.0132	0.835
	6318	OGS 6	0.06	0.65	0.11	9.35			0.00	0.70			0.00	0.00			0.00	0.00	18.01	55.46	74.94	87.72	128.02	571	900	900	CONC	0.15	12.0	701.1305	1.1021	0.1815	0.815
TRUNK 5A																																	
			1.40	0.65	2.53	2.53			0.00	0.00			0.00	0.00			0.00	0.00	13.39														
	2331	2332			0.00	2.53			0.00	0.00			0.00	0.00			0.00	0.00	13.39	65.85	89.15	104.43	152.55	167	600	600	CONC	0.15	73.5	237.8056	0.8411	1.4565	0.701
To TRUNK 5, Pipe 2332 - 2334						2.53				0.00				0.00				0.00	14.85														
TRUNK 5																																	
			0.71	0.65	1.28	1.28			0.00	0.00			0.00	0.00			0.00	0.00	11.72														
	2303	2305			0.00	1.28			0.00	0.00			0.00	0.00			0.00	0.00	11.72	70.78	95.91	112.39	164.23	91	450	450	CONC	0.20	52.5	127.5033	0.8017	1.0914	0.712

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: R.B	PROJECT: BARRHAVEN COSERVANCY EAST		
Checked: D.A.	LOCATION: City of Ottawa		
Dwg. Reference: 3	File Ref: 16-891	Date: June 2020	Sheet No. SHEET 2 OF 4

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Manning 0.013

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
			0.57	0.65	1.03	2.31			0.00	0.00			0.00	0.00			0.00	0.00	11.79														
	2305	2308			0.00	2.31			0.00	0.00			0.00	0.00			0.00	0.00	12.81	67.47	91.37	107.04	156.38	156	525	525	CONC	0.20	68.0	192.3297	0.8885	1.2756	0.811
			0.18	0.65	0.33	2.64			0.00	0.00			0.00	0.00			0.00	0.00															
			0.27	0.65	0.49	3.13			0.00	0.00			0.00	0.00			0.00	0.00	11.74														
					0.00	3.13	0.43	0.65	0.78	0.78			0.00	0.00			0.00	0.00															
	2308	2309	0.50	0.40	0.56	3.68			0.00	0.78			0.00	0.00			0.00	0.00	14.09	64.01	86.63	101.46	148.19	303	675	675	CONC	0.20	54.5	375.9224	1.0505	0.8647	0.806
	2309	2311	0.33	0.65	0.60	4.28			0.00	0.78			0.00	0.00			0.00	0.00	14.95	61.88	83.71	98.04	143.16	330	750	750	CONC	0.15	60.5	431.1703	0.9760	1.0332	0.765
			0.45	0.65	0.81	5.09			0.00	0.78			0.00	0.00			0.00	0.00	10.92														
	2311	2312			0.00	5.09			0.00	0.78			0.00	0.00			0.00	0.00	15.98	59.54	80.50	94.26	137.63	366	825	825	CONC	0.10	72.5	453.9246	0.8492	1.4230	0.806
	2312	2326	0.28	0.65	0.51	5.60			0.00	0.78			0.00	0.00			0.00	0.00	17.41	56.61	76.51	89.56	130.73	376	825	825	CONC	0.10	72.5	453.9246	0.8492	1.4230	0.829
			3.25	0.65	5.87	11.47			0.00	0.78			0.00	0.00			0.00	0.00	15.74														
	2326	2332			0.00	11.47			0.00	0.78			0.00	0.00			0.00	0.00	18.83	53.99	72.93	85.35	124.56	676	975	975	CONC	0.15	58.5	867.9562	1.1625	0.8387	0.779
Contribution From TRUNK 5A, Pipe 2331 - 2332						2.53				0.00				0.00				0.00	14.85														
	2332	OGS 5	0.30	0.65	0.54	14.54			0.00	0.78			0.00	0.00			0.00	0.00	19.67	52.57	70.98	83.07	121.21	820	1050	1050	CONC	0.15	25.0	1057.6053	1.2214	0.3411	0.775
TRUNK 4A																																	
			1.97	0.65	3.56	3.56			0.00	0.00			0.00	0.00			0.00	0.00	14.68														
			0.27	0.65	0.49	4.05			0.00	0.00			0.00	0.00			0.00	0.00															
	2224	2225			0.00	4.05	0.33	0.65	0.60	0.60			0.00	0.00			0.00	0.00	14.68	62.53	84.61	99.08	144.70	304	675	675	CONC	0.20	78.0	375.9224	1.0505	1.2375	0.808
	2225	2226	0.02	0.65	0.04	4.08			0.00	0.60			0.00	0.00			0.00	0.00	15.92	59.68	80.71	94.50	137.97	292	675	675	CONC	0.20	8.0	375.9224	1.0505	0.1269	0.776
To TRUNK 4, Pipe 2226 - OGS 4						4.08				0.60				0.00				0.00	16.04														
TRUNK 4																																	
			1.18	0.65	2.13	2.13			0.00	0.00			0.00	0.00			0.00	0.00	12.58														
	2204	2206			0.00	2.13			0.00	0.00			0.00	0.00			0.00	0.00	12.58	68.14	92.29	108.13	157.97	145	525	525	CONC	0.20	27.5	192.3297	0.8885	0.5159	0.755
			0.44	0.65	0.80	2.93			0.00	0.00			0.00	0.00			0.00	0.00	11.75														
	2206	2209			0.00	2.93			0.00	0.00			0.00	0.00			0.00	0.00	13.10	66.66	90.26	105.74	154.47	195	525	525	CONC	0.30	25.0	235.5548	1.0881	0.3829	0.828
			0.83	0.65	1.50	4.43			0.00	0.00			0.00	0.00			0.00	0.00	12.56														
	2209	2210			0.00	4.43			0.00	0.00			0.00	0.00			0.00	0.00	13.48	65.61	88.82	104.04	151.98	290	675	675	CONC	0.20	68.0	375.9224	1.0505	1.0788	0.773
					0.00	4.43	0.09	0.65	0.16	0.16			0.00	0.00			0.00	0.00															
	2210	2211	0.27	0.65	0.49	4.92			0.00	0.16			0.00	0.00			0.00	0.00	14.56	62.83	85.01	99.57	145.41	323	675	675	CONC	0.25	54.5	420.2941	1.1745	0.7734	0.768
	2211	2213	0.33	0.65	0.60	5.51			0.00	0.16			0.00	0.00			0.00	0.00	15.33	61.00	82.50	96.61	141.07	350	750	750	CONC	0.15	60.5	431.1703	0.9760	1.0332	0.811
			0.40	0.65	0.72	6.23			0.00	0.16			0.00	0.00			0.00	0.00	10.60														
	2213	2214			0.00	6.23			0.00	0.16			0.00	0.00			0.00	0.00	16.36	58.72	79.39	92.96	135.71	379	825	825	CONC	0.10	75.0	453.9246	0.8492	1.4721	0.835
	2214	2215	0.34	0.65	0.61	6.85			0.00	0.16			0.00	0.00			0.00	0.00	17.84	55.79	75.39	88.25	128.80	394	825	825	CONC	0.15	75.0	555.9418	1.0400	1.2019	0.709
	2215	2226	0.23	0.65	0.42	7.26			0.00	0.16			0.00	0.00			0.00	0.00	19.04	53.63	72.44	84.78	123.71	401	900	900	CONC	0.10	63.5	572.4707	0.8999	1.1761	0.701
Contribution From TRUNK 4A, Pipe 2225 - 2226						4.08				0.60				0.00				0.00	16.04														
	2226	OGS 4	0.02	0.65	0.04	11.38			0.00	0.76			0.00	0.00			0.00	0.00	20.21	51.69	69.78	81.66	119.15	641	975	975	CONC	0.15	23.5	867.9562	1.1625	0.3369	0.739
TRUNK 3																																	
			0.95	0.65	1.72	1.72			0.00	0.00			0.00	0.00			0.00	0.00	11.41														
	2103	2105			0.00	1.72			0.00	0.00			0.00	0.00			0.00	0.00	11.41	71.78	97.29	114.01	166.62	123	525	525	CONC	0.20	111.0	192.3297	0.8885	2.0823	0.641
			0.45	0.65	0.81	2.53			0.00	0.00			0.00	0.00			0.00	0.00	10.64														
	2105	2110			0.00	2.53			0.00	0.00			0.00	0.00			0.00	0.00	13.49	65.57	88.77	103.98	151.89	166	600	600	CONC	0.15	67.0	237.8056	0.8411	1.3277	0.698
			0.54	0.65	0.98	3.51			0.00	0.00			0.00	0.00			0.00	0.00	12.13														
	2110	OGS 3	0.67	0.40	0.75	4.25			0.00	0.00			0.00	0.00			0.00	0.00	14.82	62.20	84.14	98.54	143.91	264	675	675	CONC	0.15	25.0	325.5584	0.9098	0.4580	0.812
TRUNK 2																																	
			1.05	0.65	1.90	1.90			0.00	0.00			0.00	0.00			0.00	0.00	13.03														
	1204	1207			0.00	1.90			0.00	0.00			0.00	0.00			0.00	0.00	13.03	66.85	90.51	106.04	154.91	127	525	525	CONC	0.20	45.0	192.3297	0.8885	0.8442	0.659
			1.00	0.65	1.81	3.70			0.00	0.00			0.00	0.00			0.00	0.00	12.68														
	1207	1209			0.00	3.70			0.00	0.00			0.00	0.00			0.00	0.00	13.87	64.56	87.38	102.35	149.49	239	600	600	CONC	0.25	68.5	307.0058	1.0858	1.0514	0.779
					0.00	3.70	0.12	0.65	0.22	0.22			0.00	0.00			0.00	0.00	10.60														
			0.03	0.65	0.05	3.76			0.00	0.22			0.00	0.00			0.00	0.00															
	1209	1211	0.09	0.65	0.16	3.92			0.00	0.22			0.00	0.00			0.00	0.00	14.93	61.94	83.80	98.14	143.31	261	675	675	CONC	0.15	19.5	325.5584	0.9098	0.3572	0.802
			0.29	0.65	0.52	4.45			0.00	0.22			0.00	0.00			0.00	0.00	12.13														
			0.26	0.65	0.47	4.92			0.00	0.22			0.00	0.00			0.00	0.00															
	1211	1215			0.00	4.92	0.28	0.65	0.51	0.72			0.00	0.00			0.00	0.00	15.28	61.11	82.65	96.79	141.34	360	750	750	CONC	0.15	56.5	431.1703	0.9760	0.9649	0.835

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: R.B
Checked: D.A.
Dwg. Reference: 3

PROJECT: **BARRHAVEN COSERVANCY EAST**
LOCATION: **City of Ottawa**
File Ref: 16-891
Date: June 2020
Sheet No. SHEET 3 OF 4

891_STM_Trunk.xlsx

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
			1.20	0.65	2.17	7.08			0.00	0.72			0.00	0.00			0.00	0.00	12.38														
	1215	1217			0.00	7.08			0.00	0.72			0.00	0.00			0.00	0.00	16.25	58.97	79.73	93.35	136.29	475	750	750	CONC	0.30	58.5	609.7669	1.3802	0.7064	0.780
			0.57	0.65	1.03	8.11			0.00	0.72			0.00	0.00			0.00	0.00	10.78														
	1217	1218			0.00	8.11			0.00	0.72			0.00	0.00			0.00	0.00	16.95	57.51	77.73	91.00	132.85	523	825	825	CONC	0.20	90.0	641.9463	1.2009	1.2491	0.814
			0.94	0.65	1.70	9.81			0.00	0.72			0.00	0.00			0.00	0.00	13.42														
	1218	1260			0.00	9.81			0.00	0.72			0.00	0.00			0.00	0.00	18.20	55.11	74.46	87.15	127.20	595	900	900	CONC	0.15	3.5	701.1305	1.1021	0.0529	0.848
	1260	OGS 2			0.00	9.81			0.00	0.72			0.00	0.00			0.00	0.00	18.20	55.11	74.46	87.15	127.20	595	900	900	CONC	0.15	22.5	701.1305	1.1021	0.3403	0.848
TRUNK 1																																	
			0.89	0.65	1.61	1.61			0.00	0.00			0.00	0.00			0.00	0.00	10.75														
	1103	1104			0.00	1.61			0.00	0.00			0.00	0.00			0.00	0.00	10.75	74.04	100.39	117.66	171.98	119	450	450	CONC	0.25	109.0	142.5531	0.8963	2.0268	0.835
			0.60	0.65	1.08	2.69			0.00	0.00			0.00	0.00			0.00	0.00															
	1104	1106	0.76	0.40	0.85	3.54			0.00	0.00			0.00	0.00			0.00	0.00	12.78	67.57	91.50	107.20	156.62	239	675	675	CONC	0.15	108.5	325.5584	0.9098	1.9877	0.734
			0.56	0.65	1.01	4.55			0.00	0.00			0.00	0.00			0.00	0.00	11.63														
	1106	1108			0.00	4.55			0.00	0.00			0.00	0.00			0.00	0.00	14.76	62.33	84.33	98.76	144.22	284	675	675	CONC	0.20	64.5	375.9224	1.0505	1.0233	0.754
			0.82	0.65	1.48	6.03			0.00	0.00			0.00	0.00			0.00	0.00	12.30														
	1108	1117			0.00	6.03			0.00	0.00			0.00	0.00			0.00	0.00	15.79	59.97	81.10	94.96	138.65	362	750	750	CONC	0.15	58.5	431.1703	0.9760	0.9990	0.839
					0.00	6.03	0.29	0.65	0.52	0.52			0.00	0.00			0.00	0.00															
			0.52	0.65	0.94	6.97			0.00	0.52			0.00	0.00			0.00	0.00															
	1117	1122	1.04	0.65	1.88	8.85			0.00	0.52			0.00	0.00			0.00	0.00	16.79	57.85	78.20	91.55	133.64	553	825	825	CONC	0.25	17.0	717.7178	1.3426	0.2110	0.770
			0.08	0.65	0.14	8.99			0.00	0.52			0.00	0.00			0.00	0.00	15.57														
	1122	1121			0.00	8.99			0.00	0.52			0.00	0.00			0.00	0.00	17.00	57.42	77.61	90.86	132.64	557	825	825	CONC	0.25	9.0	717.7178	1.3426	0.1117	0.776
	1121	1120	0.06	0.65	0.11	9.10			0.00	0.52			0.00	0.00			0.00	0.00	17.11	57.20	77.31	90.50	132.11	561	900	900	CONC	0.15	48.5	701.1305	1.1021	0.7334	0.800
			0.64	0.65	1.16	10.26			0.00	0.52			0.00	0.00			0.00	0.00	12.10														
	1120	OGS 1			0.00	10.26			0.00	0.52			0.00	0.00			0.00	0.00	17.84	55.78	75.37	88.23	128.77	612	900	900	CONC	0.20	3.5	809.5958	1.2726	0.0458	0.756

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: R.B	PROJECT: BARRHAVEN COSERVANCY EAST	
Checked: D.A.	LOCATION: City of Ottawa	
Dwg. Reference: 3	File Ref: 16-891	Date: June 2020
		Sheet No. SHEET 4 OF 4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	891 Caivan	**Engineer:**	**DSEL**
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	1	**Report Date:**	22-May-20

Area	6.24	ha	**Rainfall Station #**	215	
Weighted C	0.65		**Particle Size Distribution**	FINE	
CDS Model	4040		**CDS Treatment Capacity**	170	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	5.6	5.6	3.3	97.9	9.0
1.0	10.6%	19.8%	11.3	11.3	6.6	97.0	10.3
1.5	9.9%	29.7%	16.9	16.9	10.0	96.0	9.5
2.0	8.4%	38.1%	22.6	22.6	13.3	95.1	8.0
2.5	7.7%	45.8%	28.2	28.2	16.6	94.1	7.2
3.0	5.9%	51.7%	33.8	33.8	19.9	93.2	5.5
3.5	4.4%	56.1%	39.5	39.5	23.2	92.2	4.0
4.0	4.7%	60.7%	45.1	45.1	26.5	91.2	4.3
4.5	3.3%	64.0%	50.7	50.7	29.9	90.3	3.0
5.0	3.0%	67.1%	56.4	56.4	33.2	89.3	2.7
6.0	5.4%	72.4%	67.7	67.7	39.8	87.4	4.7
7.0	4.4%	76.8%	78.9	78.9	46.5	85.5	3.7
8.0	3.5%	80.3%	90.2	90.2	53.1	83.6	3.0
9.0	2.8%	83.2%	101.5	101.5	59.7	81.7	2.3
10.0	2.2%	85.3%	112.8	112.8	66.4	79.8	1.7
15.0	7.0%	92.3%	169.1	169.1	99.5	70.3	4.9
20.0	4.5%	96.9%	225.5	169.9	100.0	52.9	2.4
25.0	1.4%	98.3%	281.9	169.9	100.0	42.3	0.6
30.0	0.7%	99.0%	338.3	169.9	100.0	35.3	0.2
35.0	0.5%	99.5%	394.6	169.9	100.0	30.2	0.1
40.0	0.5%	100.0%	451.0	169.9	100.0	26.4	0.1
45.0	0.0%	100.0%	507.4	169.9	100.0	23.5	0.0
50.0	0.0%	100.0%	563.8	169.9	100.0	21.2	0.0
							87.4

Removal Efficiency Adjustment[2] =	6.5%
Predicted Net Annual Load Removal Efficiency =	**80.9%**
Predicted % Annual Rainfall Treated =	**97.4%**

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CONTECH ENGINEERED SOLUTIONS

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD BASED ON A FINE PARTICLE SIZE DISTRIBUTION

CDS TECHNOLOGIES

Project Name:	891 Caivan	**Engineer:**	**DSEL**
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	2	**Report Date:**	22-May-20

Area	5.82	ha	**Rainfall Station #**	215	
Weighted C	0.65		**Particle Size Distribution**	FINE	
CDS Model	4040		**CDS Treatment Capacity**	170	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	5.3	5.3	3.1	98.0	9.0
1.0	10.6%	19.8%	10.5	10.5	6.2	97.1	10.3
1.5	9.9%	29.7%	15.8	15.8	9.3	96.2	9.5
2.0	8.4%	38.1%	21.0	21.0	12.4	95.3	8.0
2.5	7.7%	45.8%	26.3	26.3	15.5	94.4	7.3
3.0	5.9%	51.7%	31.6	31.6	18.6	93.5	5.6
3.5	4.4%	56.1%	36.8	36.8	21.7	92.6	4.0
4.0	4.7%	60.7%	42.1	42.1	24.8	91.8	4.3
4.5	3.3%	64.0%	47.3	47.3	27.9	90.9	3.0
5.0	3.0%	67.1%	52.6	52.6	30.9	90.0	2.7
6.0	5.4%	72.4%	63.1	63.1	37.1	88.2	4.8
7.0	4.4%	76.8%	73.6	73.6	43.3	86.4	3.8
8.0	3.5%	80.3%	84.1	84.1	49.5	84.7	3.0
9.0	2.8%	83.2%	94.7	94.7	55.7	82.9	2.3
10.0	2.2%	85.3%	105.2	105.2	61.9	81.1	1.8
15.0	7.0%	92.3%	157.8	157.8	92.8	72.2	5.0
20.0	4.5%	96.9%	210.3	169.9	100.0	56.7	2.6
25.0	1.4%	98.3%	262.9	169.9	100.0	45.4	0.7
30.0	0.7%	99.0%	315.5	169.9	100.0	37.8	0.3
35.0	0.5%	99.5%	368.1	169.9	100.0	32.4	0.2
40.0	0.5%	100.0%	420.7	169.9	100.0	28.4	0.2
45.0	0.0%	100.0%	473.3	169.9	100.0	25.2	0.0
50.0	0.0%	100.0%	525.8	169.9	100.0	22.7	0.0
							88.1

Removal Efficiency Adjustment[2] =	6.5%
Predicted Net Annual Load Removal Efficiency =	**81.6%**
Predicted % Annual Rainfall Treated =	**97.7%**

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

3 - CDS Efficiency based on testing conducted at the University of Central Florida

4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	891 Caivan	**Engineer:**	**DSEL**
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	3	**Report Date:**	22-May-20

Area	2.63	ha	**Rainfall Station #**	215	
Weighted C	0.65		**Particle Size Distribution**	FINE	
CDS Model	3025		**CDS Treatment Capacity**	68	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	2.4	2.4	3.5	97.9	9.0
1.0	10.6%	19.8%	4.8	4.8	7.0	96.9	10.3
1.5	9.9%	29.7%	7.1	7.1	10.5	95.9	9.5
2.0	8.4%	38.1%	9.5	9.5	14.0	94.8	7.9
2.5	7.7%	45.8%	11.9	11.9	17.5	93.8	7.2
3.0	5.9%	51.7%	14.3	14.3	21.0	92.8	5.5
3.5	4.4%	56.1%	16.6	16.6	24.5	91.8	4.0
4.0	4.7%	60.7%	19.0	19.0	28.0	90.8	4.2
4.5	3.3%	64.0%	21.4	21.4	31.5	89.8	3.0
5.0	3.0%	67.1%	23.8	23.8	35.0	88.8	2.7
6.0	5.4%	72.4%	28.5	28.5	42.0	86.8	4.7
7.0	4.4%	76.8%	33.3	33.3	48.9	84.8	3.7
8.0	3.5%	80.3%	38.0	38.0	55.9	82.8	2.9
9.0	2.8%	83.2%	42.8	42.8	62.9	80.8	2.3
10.0	2.2%	85.3%	47.5	47.5	69.9	78.8	1.7
15.0	7.0%	92.3%	71.3	68.0	100.0	66.9	4.7
20.0	4.5%	96.9%	95.0	68.0	100.0	50.2	2.3
25.0	1.4%	98.3%	118.8	68.0	100.0	40.2	0.6
30.0	0.7%	99.0%	142.6	68.0	100.0	33.5	0.2
35.0	0.5%	99.5%	166.3	68.0	100.0	28.7	0.1
40.0	0.5%	100.0%	190.1	68.0	100.0	25.1	0.1
45.0	0.0%	100.0%	213.9	68.0	100.0	22.3	0.0
50.0	0.0%	100.0%	237.6	68.0	100.0	20.1	0.0
							86.7
						Removal Efficiency Adjustment[2] =	6.5%
						Predicted Net Annual Load Removal Efficiency =	**80.2%**
						Predicted % Annual Rainfall Treated =	**96.8%**

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

CONTECH ENGINEERED SOLUTIONS | CDS TECHNOLOGIES

Project Name:	891 Caivan	**Engineer:**	**DSEL**
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	4	**Report Date:**	22-May-20

Area	6.66	ha	**Rainfall Station #**	215	
Weighted C	0.65		**Particle Size Distribution**	FINE	
CDS Model	4040		**CDS Treatment Capacity**	170	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	6.0	6.0	3.5	97.8	9.0
1.0	10.6%	19.8%	12.0	12.0	7.1	96.8	10.3
1.5	9.9%	29.7%	18.1	18.1	10.6	95.8	9.5
2.0	8.4%	38.1%	24.1	24.1	14.2	94.8	7.9
2.5	7.7%	45.8%	30.1	30.1	17.7	93.8	7.2
3.0	5.9%	51.7%	36.1	36.1	21.2	92.8	5.5
3.5	4.4%	56.1%	42.1	42.1	24.8	91.8	4.0
4.0	4.7%	60.7%	48.1	48.1	28.3	90.7	4.2
4.5	3.3%	64.0%	54.2	54.2	31.9	89.7	3.0
5.0	3.0%	67.1%	60.2	60.2	35.4	88.7	2.7
6.0	5.4%	72.4%	72.2	72.2	42.5	86.7	4.7
7.0	4.4%	76.8%	84.2	84.2	49.6	84.6	3.7
8.0	3.5%	80.3%	96.3	96.3	56.7	82.6	2.9
9.0	2.8%	83.2%	108.3	108.3	63.7	80.6	2.3
10.0	2.2%	85.3%	120.3	120.3	70.8	78.6	1.7
15.0	7.0%	92.3%	180.5	169.9	100.0	66.1	4.6
20.0	4.5%	96.9%	240.7	169.9	100.0	49.6	2.3
25.0	1.4%	98.3%	300.9	169.9	100.0	39.6	0.6
30.0	0.7%	99.0%	361.0	169.9	100.0	33.0	0.2
35.0	0.5%	99.5%	421.2	169.9	100.0	28.3	0.1
40.0	0.5%	100.0%	481.4	169.9	100.0	24.8	0.1
45.0	0.0%	100.0%	541.6	169.9	100.0	22.0	0.0
50.0	0.0%	100.0%	601.7	169.9	100.0	19.8	0.0
							86.5

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 80.0%

Predicted % Annual Rainfall Treated = 96.6%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	891 Caivan	**Engineer:**	**DSEL**
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	5	**Report Date:**	22-May-20

Area	8.66	ha	**Rainfall Station #**	215	
Weighted C	0.65		**Particle Size Distribution**	FINE	
CDS Model	5640		**CDS Treatment Capacity**	255	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	7.8	7.8	3.1	98.0	9.0
1.0	10.6%	19.8%	15.6	15.6	6.1	97.1	10.3
1.5	9.9%	29.7%	23.5	23.5	9.2	96.2	9.5
2.0	8.4%	38.1%	31.3	31.3	12.3	95.3	8.0
2.5	7.7%	45.8%	39.1	39.1	15.3	94.5	7.3
3.0	5.9%	51.7%	46.9	46.9	18.4	93.6	5.6
3.5	4.4%	56.1%	54.8	54.8	21.5	92.7	4.0
4.0	4.7%	60.7%	62.6	62.6	24.6	91.8	4.3
4.5	3.3%	64.0%	70.4	70.4	27.6	90.9	3.0
5.0	3.0%	67.1%	78.2	78.2	30.7	90.1	2.7
6.0	5.4%	72.4%	93.9	93.9	36.8	88.3	4.8
7.0	4.4%	76.8%	109.5	109.5	43.0	86.5	3.8
8.0	3.5%	80.3%	125.2	125.2	49.1	84.8	3.0
9.0	2.8%	83.2%	140.8	140.8	55.3	83.0	2.3
10.0	2.2%	85.3%	156.5	156.5	61.4	81.3	1.8
15.0	7.0%	92.3%	234.7	234.7	92.1	72.5	5.1
20.0	4.5%	96.9%	313.0	254.9	100.0	57.2	2.6
25.0	1.4%	98.3%	391.2	254.9	100.0	45.7	0.7
30.0	0.7%	99.0%	469.5	254.9	100.0	38.1	0.3
35.0	0.5%	99.5%	547.7	254.9	100.0	32.7	0.2
40.0	0.5%	100.0%	625.9	254.9	100.0	28.6	0.2
45.0	0.0%	100.0%	704.2	254.9	100.0	25.4	0.0
50.0	0.0%	100.0%	782.4	254.9	100.0	22.9	0.0
							88.2

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 81.7%

Predicted % Annual Rainfall Treated = 97.8%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

3 - CDS Efficiency based on testing conducted at the University of Central Florida

4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	891 Caivan	**Engineer:**	DSEL
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	6	**Report Date:**	22-May-20

Area	5.92	ha	**Rainfall Station #**	215	
Weighted C	0.65		**Particle Size Distribution**	FINE	
CDS Model	4040		**CDS Treatment Capacity**	170	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	5.3	5.3	3.1	98.0	9.0
1.0	10.6%	19.8%	10.7	10.7	6.3	97.1	10.3
1.5	9.9%	29.7%	16.0	16.0	9.4	96.2	9.5
2.0	8.4%	38.1%	21.4	21.4	12.6	95.2	8.0
2.5	7.7%	45.8%	26.7	26.7	15.7	94.3	7.3
3.0	5.9%	51.7%	32.1	32.1	18.9	93.4	5.6
3.5	4.4%	56.1%	37.4	37.4	22.0	92.5	4.0
4.0	4.7%	60.7%	42.8	42.8	25.2	91.6	4.3
4.5	3.3%	64.0%	48.1	48.1	28.3	90.7	3.0
5.0	3.0%	67.1%	53.5	53.5	31.5	89.8	2.7
6.0	5.4%	72.4%	64.2	64.2	37.8	88.0	4.7
7.0	4.4%	76.8%	74.9	74.9	44.1	86.2	3.8
8.0	3.5%	80.3%	85.6	85.6	50.4	84.4	3.0
9.0	2.8%	83.2%	96.3	96.3	56.7	82.6	2.3
10.0	2.2%	85.3%	107.0	107.0	63.0	80.8	1.8
15.0	7.0%	92.3%	160.5	160.5	94.4	71.8	5.0
20.0	4.5%	96.9%	213.9	169.9	100.0	55.7	2.5
25.0	1.4%	98.3%	267.4	169.9	100.0	44.6	0.6
30.0	0.7%	99.0%	320.9	169.9	100.0	37.2	0.2
35.0	0.5%	99.5%	374.4	169.9	100.0	31.9	0.2
40.0	0.5%	100.0%	427.9	169.9	100.0	27.9	0.2
45.0	0.0%	100.0%	481.4	169.9	100.0	24.8	0.0
50.0	0.0%	100.0%	534.9	169.9	100.0	22.3	0.0
							87.9

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 81.4%

Predicted % Annual Rainfall Treated = 97.6%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	891 Caivan	**Engineer:**	**DSEL**
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	7	**Report Date:**	22-May-20

Area	9.30	ha	**Rainfall Station #**	215	
Weighted C	0.73		**Particle Size Distribution**	FINE	
CDS Model	5653		**CDS Treatment Capacity**	396	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	9.4	9.4	2.4	98.2	9.0
1.0	10.6%	19.8%	18.9	18.9	4.8	97.5	10.4
1.5	9.9%	29.7%	28.3	28.3	7.1	96.8	9.6
2.0	8.4%	38.1%	37.7	37.7	9.5	96.1	8.1
2.5	7.7%	45.8%	47.2	47.2	11.9	95.4	7.3
3.0	5.9%	51.7%	56.6	56.6	14.3	94.8	5.6
3.5	4.4%	56.1%	66.1	66.1	16.7	94.1	4.1
4.0	4.7%	60.7%	75.5	75.5	19.0	93.4	4.4
4.5	3.3%	64.0%	84.9	84.9	21.4	92.7	3.1
5.0	3.0%	67.1%	94.4	94.4	23.8	92.0	2.8
6.0	5.4%	72.4%	113.2	113.2	28.6	90.7	4.9
7.0	4.4%	76.8%	132.1	132.1	33.3	89.3	3.9
8.0	3.5%	80.3%	151.0	151.0	38.1	87.9	3.1
9.0	2.8%	83.2%	169.9	169.9	42.8	86.6	2.4
10.0	2.2%	85.3%	188.7	188.7	47.6	85.2	1.9
15.0	7.0%	92.3%	283.1	283.1	71.4	78.4	5.5
20.0	4.5%	96.9%	377.5	377.5	95.2	71.6	3.3
25.0	1.4%	98.3%	471.8	396.5	100.0	59.0	0.9
30.0	0.7%	99.0%	566.2	396.5	100.0	49.2	0.3
35.0	0.5%	99.5%	660.6	396.5	100.0	42.1	0.2
40.0	0.5%	100.0%	754.9	396.5	100.0	36.9	0.2
45.0	0.0%	100.0%	849.3	396.5	100.0	32.8	0.0
50.0	0.0%	100.0%	943.7	396.5	100.0	29.5	0.0
							90.8

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 84.3%

Predicted % Annual Rainfall Treated = 99.1%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name: 891 Caivan
Location: Ottawa, ON
OGS #: 8

Engineer: DSEL
Contact: A. Fobert, P.Eng.
Report Date: 22-May-20

Area 5.42 ha
Weighted C 0.65
CDS Model 4040

Rainfall Station # 215
Particle Size Distribution FINE
CDS Treatment Capacity 170 l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	4.9	4.9	2.9	98.0	9.0
1.0	10.6%	19.8%	9.8	9.8	5.8	97.2	10.3
1.5	9.9%	29.7%	14.7	14.7	8.6	96.4	9.5
2.0	8.4%	38.1%	19.6	19.6	11.5	95.6	8.0
2.5	7.7%	45.8%	24.5	24.5	14.4	94.7	7.3
3.0	5.9%	51.7%	29.4	29.4	17.3	93.9	5.6
3.5	4.4%	56.1%	34.3	34.3	20.2	93.1	4.1
4.0	4.7%	60.7%	39.2	39.2	23.1	92.2	4.3
4.5	3.3%	64.0%	44.1	44.1	25.9	91.4	3.0
5.0	3.0%	67.1%	49.0	49.0	28.8	90.6	2.7
6.0	5.4%	72.4%	58.8	58.8	34.6	88.9	4.8
7.0	4.4%	76.8%	68.6	68.6	40.3	87.3	3.8
8.0	3.5%	80.3%	78.4	78.4	46.1	85.6	3.0
9.0	2.8%	83.2%	88.1	88.1	51.9	84.0	2.4
10.0	2.2%	85.3%	97.9	97.9	57.6	82.3	1.8
15.0	7.0%	92.3%	146.9	146.9	86.5	74.1	5.2
20.0	4.5%	96.9%	195.9	169.9	100.0	60.9	2.8
25.0	1.4%	98.3%	244.8	169.9	100.0	48.7	0.7
30.0	0.7%	99.0%	293.8	169.9	100.0	40.6	0.3
35.0	0.5%	99.5%	342.8	169.9	100.0	34.8	0.2
40.0	0.5%	100.0%	391.8	169.9	100.0	30.4	0.2
45.0	0.0%	100.0%	440.7	169.9	100.0	27.1	0.0
50.0	0.0%	100.0%	489.7	169.9	100.0	24.4	0.0
							88.9

Removal Efficiency Adjustment[2] = 6.5%
Predicted Net Annual Load Removal Efficiency = 82.4%
Predicted % Annual Rainfall Treated = 98.1%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	891 Caivan	**Engineer:**	**DSEL**
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	9	**Report Date:**	22-May-20

Area	4.18	ha	**Rainfall Station #**	215	
Weighted C	0.65		**Particle Size Distribution**	FINE	
CDS Model	3035		**CDS Treatment Capacity**	108	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	3.8	3.8	3.5	97.9	9.0
1.0	10.6%	19.8%	7.6	7.6	7.0	96.8	10.3
1.5	9.9%	29.7%	11.3	11.3	10.5	95.8	9.5
2.0	8.4%	38.1%	15.1	15.1	14.0	94.8	7.9
2.5	7.7%	45.8%	18.9	18.9	17.5	93.8	7.2
3.0	5.9%	51.7%	22.7	22.7	21.1	92.8	5.5
3.5	4.4%	56.1%	26.4	26.4	24.6	91.8	4.0
4.0	4.7%	60.7%	30.2	30.2	28.1	90.8	4.2
4.5	3.3%	64.0%	34.0	34.0	31.6	89.8	3.0
5.0	3.0%	67.1%	37.8	37.8	35.1	88.8	2.7
6.0	5.4%	72.4%	45.3	45.3	42.1	86.8	4.7
7.0	4.4%	76.8%	52.9	52.9	49.1	84.8	3.7
8.0	3.5%	80.3%	60.4	60.4	56.1	82.8	2.9
9.0	2.8%	83.2%	68.0	68.0	63.2	80.8	2.3
10.0	2.2%	85.3%	75.5	75.5	70.2	78.7	1.7
15.0	7.0%	92.3%	113.3	107.6	100.0	66.7	4.7
20.0	4.5%	96.9%	151.1	107.6	100.0	50.0	2.3
25.0	1.4%	98.3%	188.8	107.6	100.0	40.0	0.6
30.0	0.7%	99.0%	226.6	107.6	100.0	33.3	0.2
35.0	0.5%	99.5%	264.4	107.6	100.0	28.6	0.1
40.0	0.5%	100.0%	302.1	107.6	100.0	25.0	0.1
45.0	0.0%	100.0%	339.9	107.6	100.0	22.2	0.0
50.0	0.0%	100.0%	377.7	107.6	100.0	20.0	0.0
							86.6

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 80.1%

Predicted % Annual Rainfall Treated = 96.7%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	891 Caivan	**Engineer:**	**DSEL**
Location:	Ottawa, ON	**Contact:**	A. Fobert, P.Eng.
OGS #:	10	**Report Date:**	22-May-20

Area	3.91	ha	**Rainfall Station #**	215	
Weighted C	0.65		**Particle Size Distribution**	FINE	
CDS Model	3035		**CDS Treatment Capacity**	108	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	3.5	3.5	3.3	97.9	9.0
1.0	10.6%	19.8%	7.1	7.1	6.6	97.0	10.3
1.5	9.9%	29.7%	10.6	10.6	9.8	96.0	9.5
2.0	8.4%	38.1%	14.1	14.1	13.1	95.1	8.0
2.5	7.7%	45.8%	17.7	17.7	16.4	94.2	7.2
3.0	5.9%	51.7%	21.2	21.2	19.7	93.2	5.5
3.5	4.4%	56.1%	24.7	24.7	23.0	92.3	4.0
4.0	4.7%	60.7%	28.3	28.3	26.3	91.3	4.3
4.5	3.3%	64.0%	31.8	31.8	29.5	90.4	3.0
5.0	3.0%	67.1%	35.3	35.3	32.8	89.4	2.7
6.0	5.4%	72.4%	42.4	42.4	39.4	87.6	4.7
7.0	4.4%	76.8%	49.5	49.5	46.0	85.7	3.7
8.0	3.5%	80.3%	56.5	56.5	52.5	83.8	3.0
9.0	2.8%	83.2%	63.6	63.6	59.1	81.9	2.3
10.0	2.2%	85.3%	70.7	70.7	65.7	80.0	1.7
15.0	7.0%	92.3%	106.0	106.0	98.5	70.6	4.9
20.0	4.5%	96.9%	141.3	107.6	100.0	53.5	2.4
25.0	1.4%	98.3%	176.6	107.6	100.0	42.8	0.6
30.0	0.7%	99.0%	212.0	107.6	100.0	35.6	0.2
35.0	0.5%	99.5%	247.3	107.6	100.0	30.5	0.1
40.0	0.5%	100.0%	282.6	107.6	100.0	26.7	0.1
45.0	0.0%	100.0%	317.9	107.6	100.0	23.8	0.0
50.0	0.0%	100.0%	353.3	107.6	100.0	21.4	0.0
							87.5

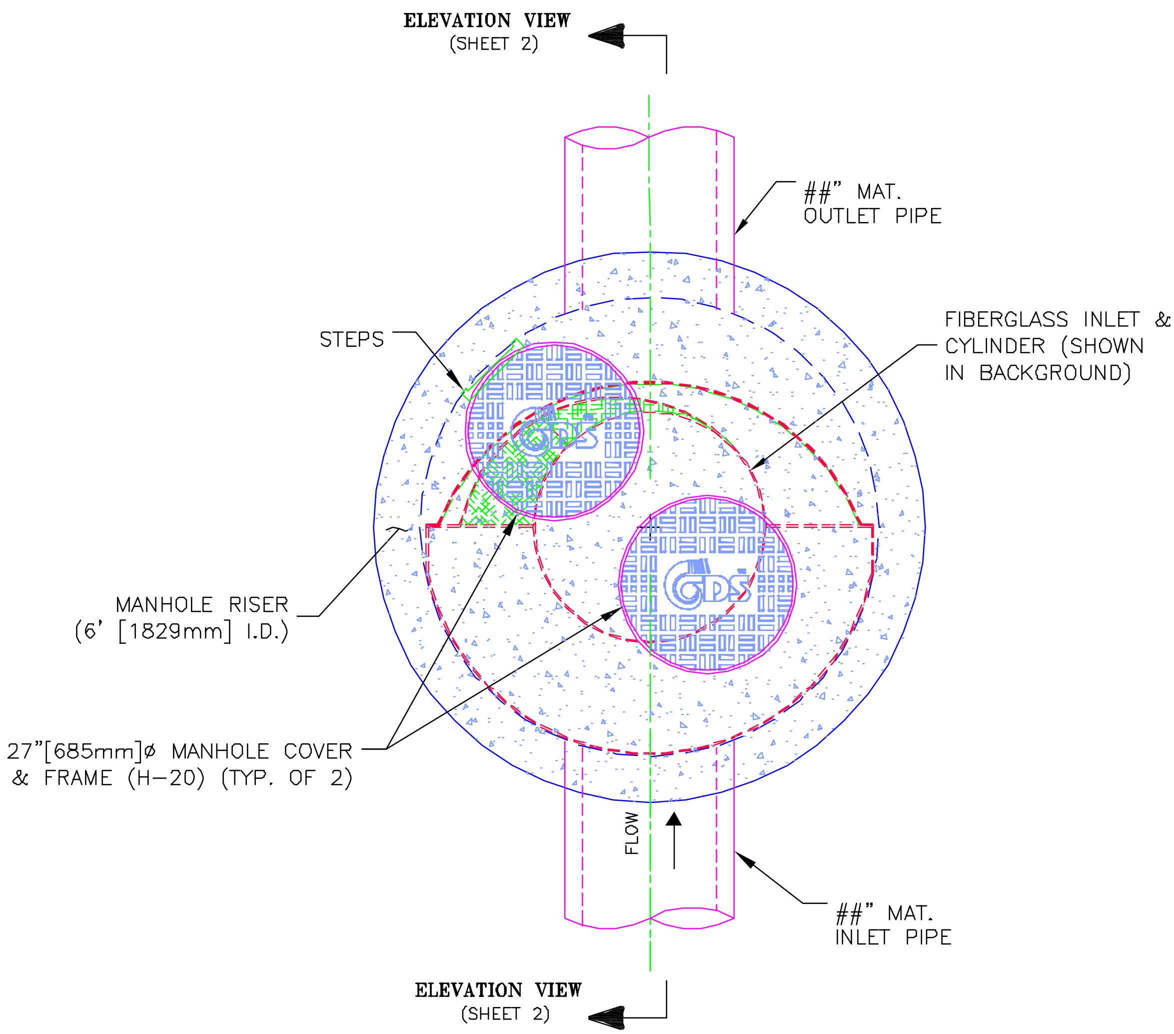
Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 81.0%

Predicted % Annual Rainfall Treated = 97.4%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

PLAN VIEW

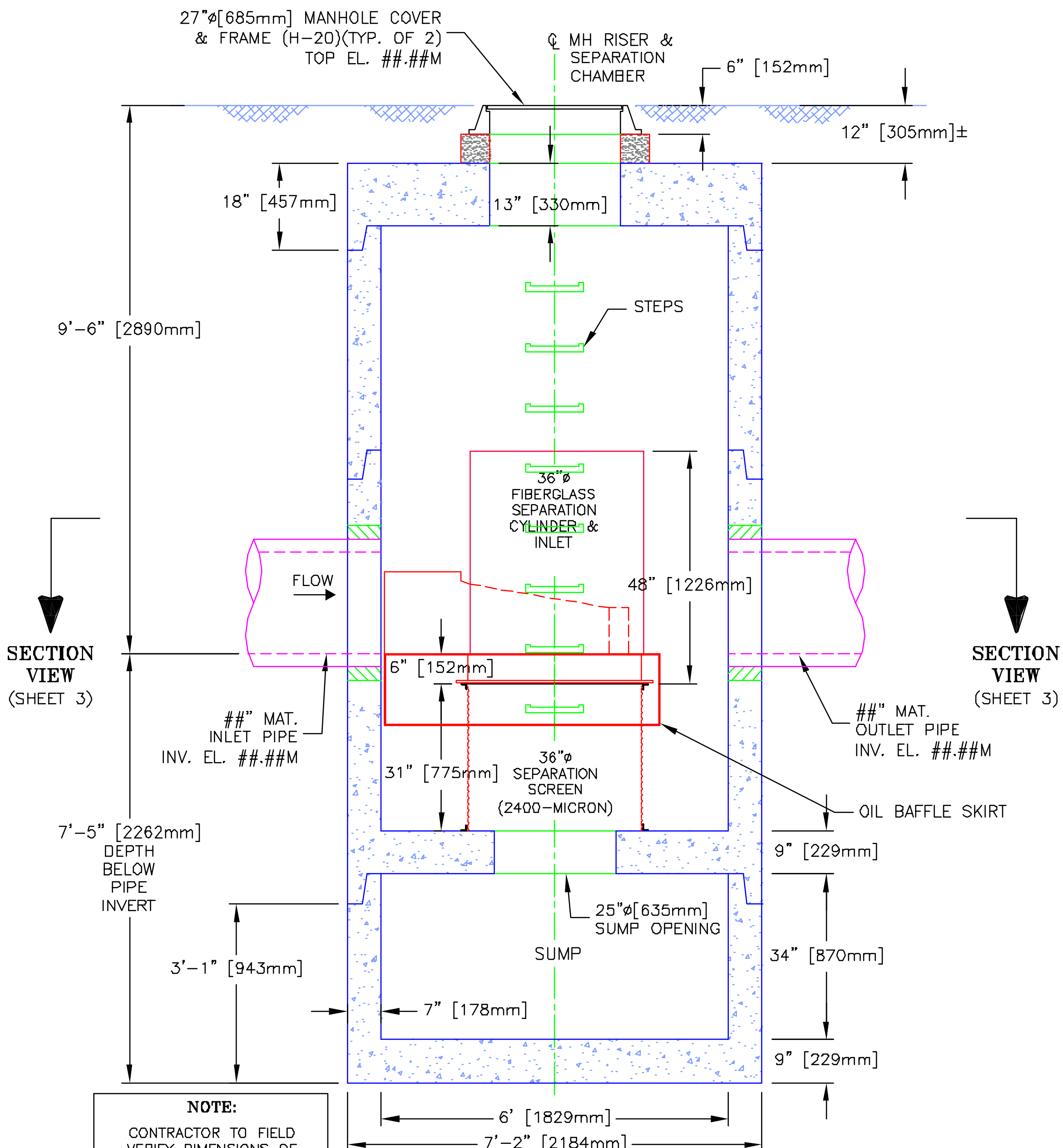


MODEL CDS30_25m, 68 L/S TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	CAN-##-###	SCALE 1" = 2.5'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	1
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

ELEVATION VIEW



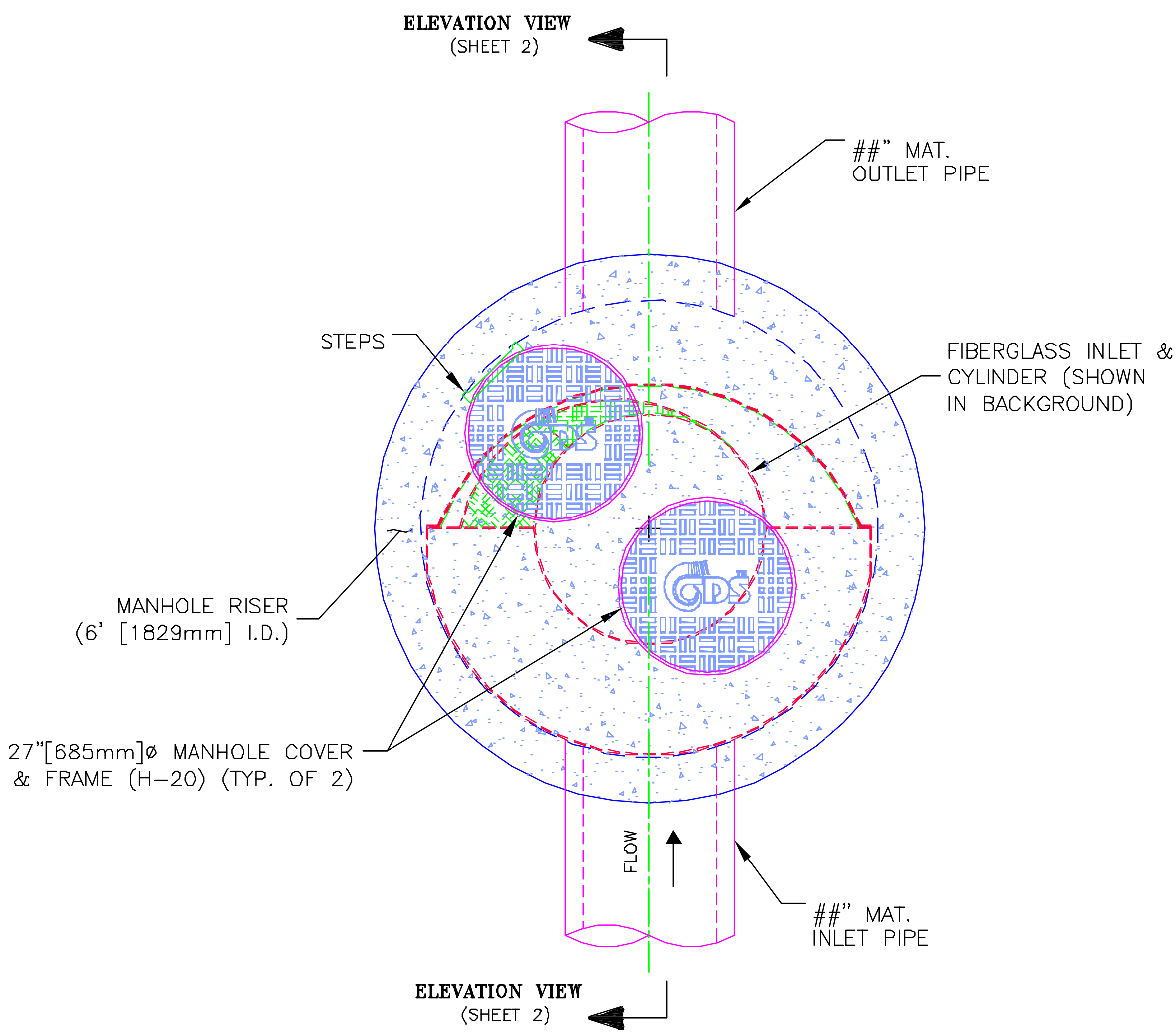
NOTE:
CONTRACTOR TO FIELD VERIFY DIMENSIONS OF OR CONCRETE SECTIONS

MODEL CDS30_25m, 68 L/S TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# CAN-##-###	SCALE 1" = 3'
		DATE ##/##/##	SHEET
		DRAWN INITIALS	2
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

PLAN VIEW

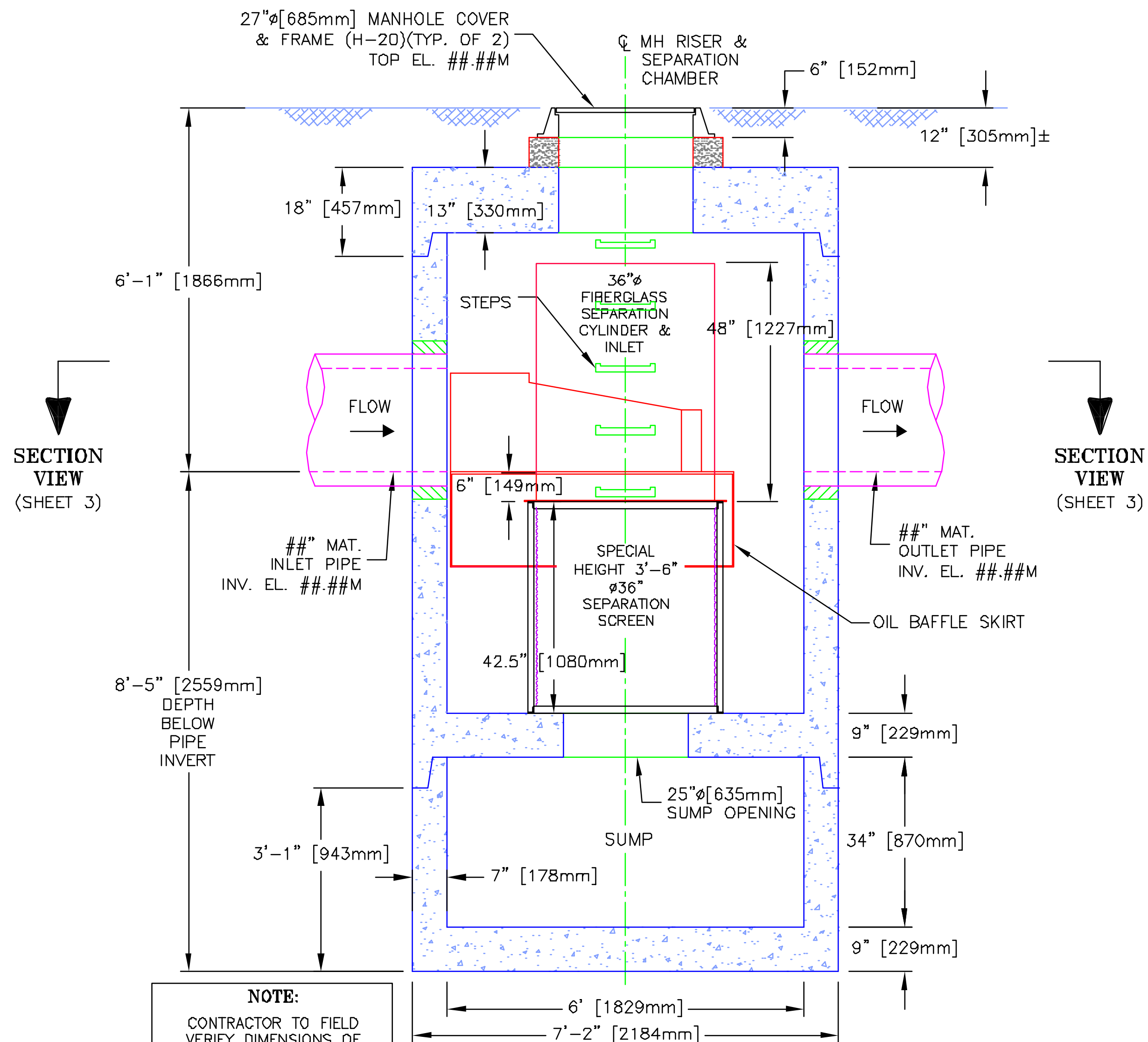


CDS MODEL PMSU30_35m
STORM WATER TREATMENT UNIT
FLOW RATE 106 L/S

CONTECH STORMWATER SOLUTIONS INC.	PROJECT NAME CITY, STATE	JOB#	CAN-##-###	SCALE 1" = 2.5'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	1
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

ELEVATION VIEW



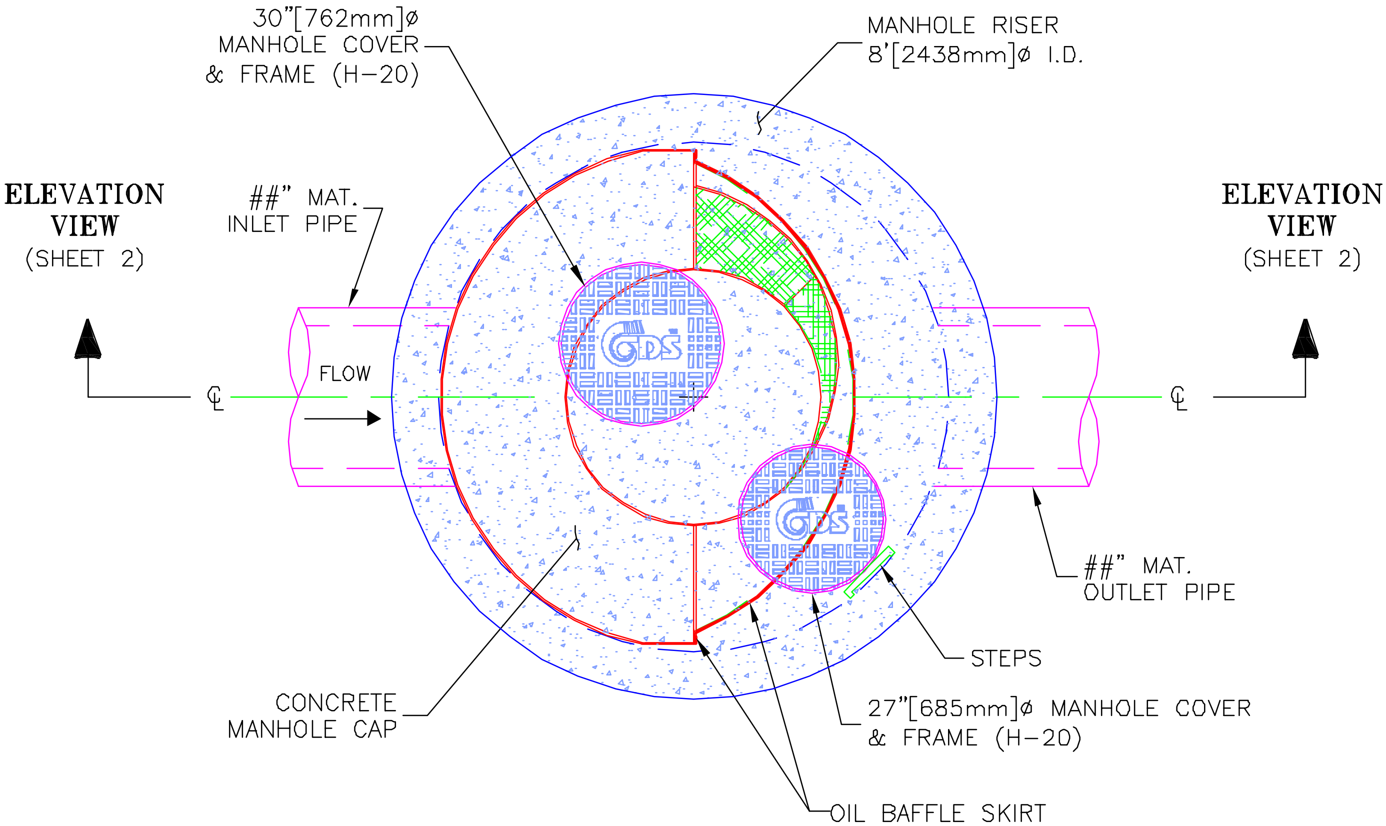
NOTE:
CONTRACTOR TO FIELD VERIFY DIMENSIONS OF OR CONCRETE SECTIONS

CDS MODEL PMSU30_35m
STORM WATER TREATMENT UNIT
FLOW RATE 106 L/S

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	CAN-##-###	SCALE 1" = 3'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	2
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

PLAN VIEW

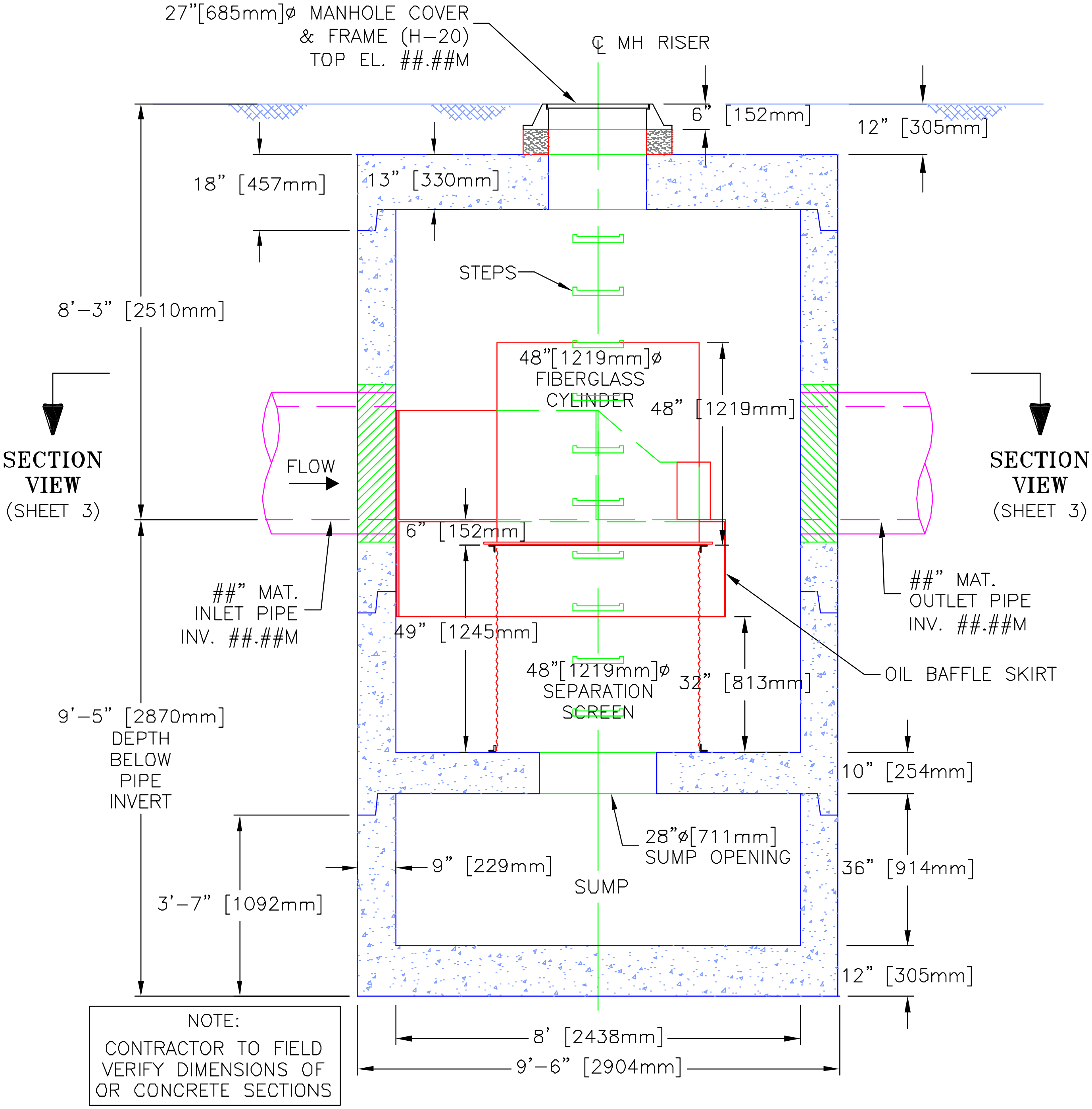


CDS MODEL PMSU40_40m, 6.0 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	XX-##-###	SCALE 1" = 3'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	1
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

ELEVATION VIEW



CDS MODEL PMSU40_40m, 6.0 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

PROJECT NAME

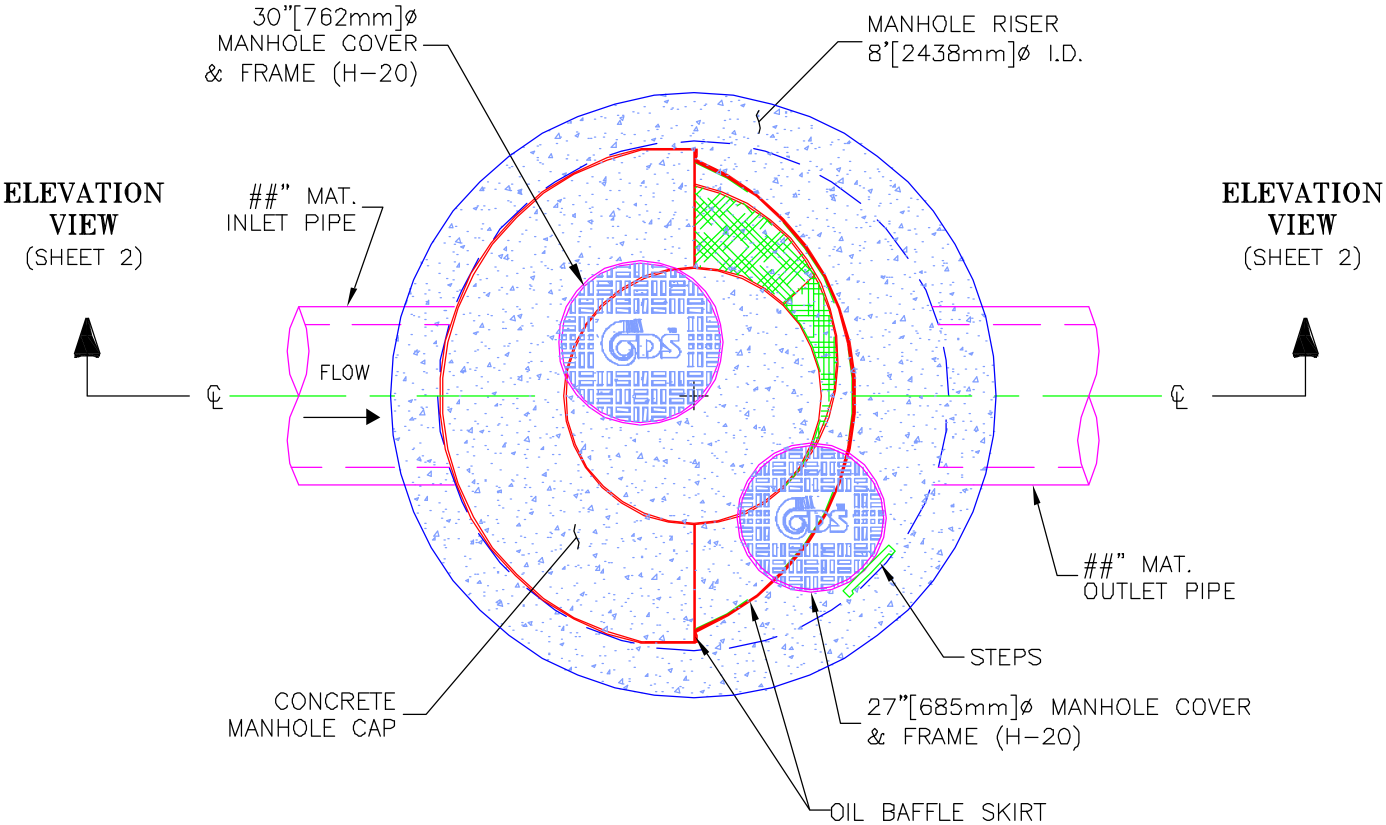
CITY, STATE

JOB#	XX–##–###	SCALE 1" = 3'
DATE	##/##/##	SHEET
DRAWN	INITIALS	2
APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948–0000 Fax: (905) 948–0577

CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848–9955

PLAN VIEW

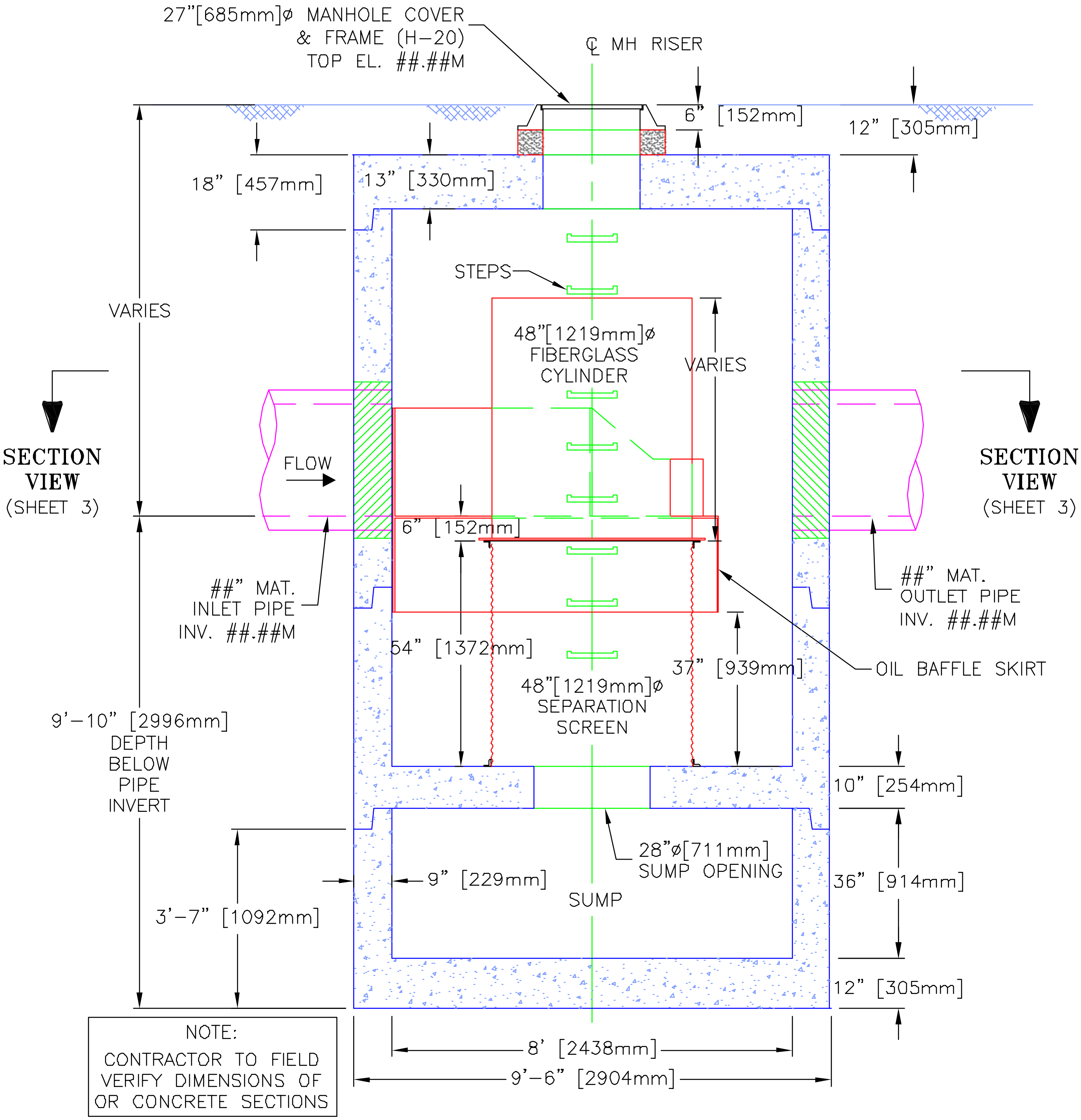


CDS MODEL PMSU40_45m, 7.5 CFS TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	XX-##-###	SCALE 1" = 3'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	1
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

ELEVATION VIEW



CDS MODEL PMSU40_45m, 7.5 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS

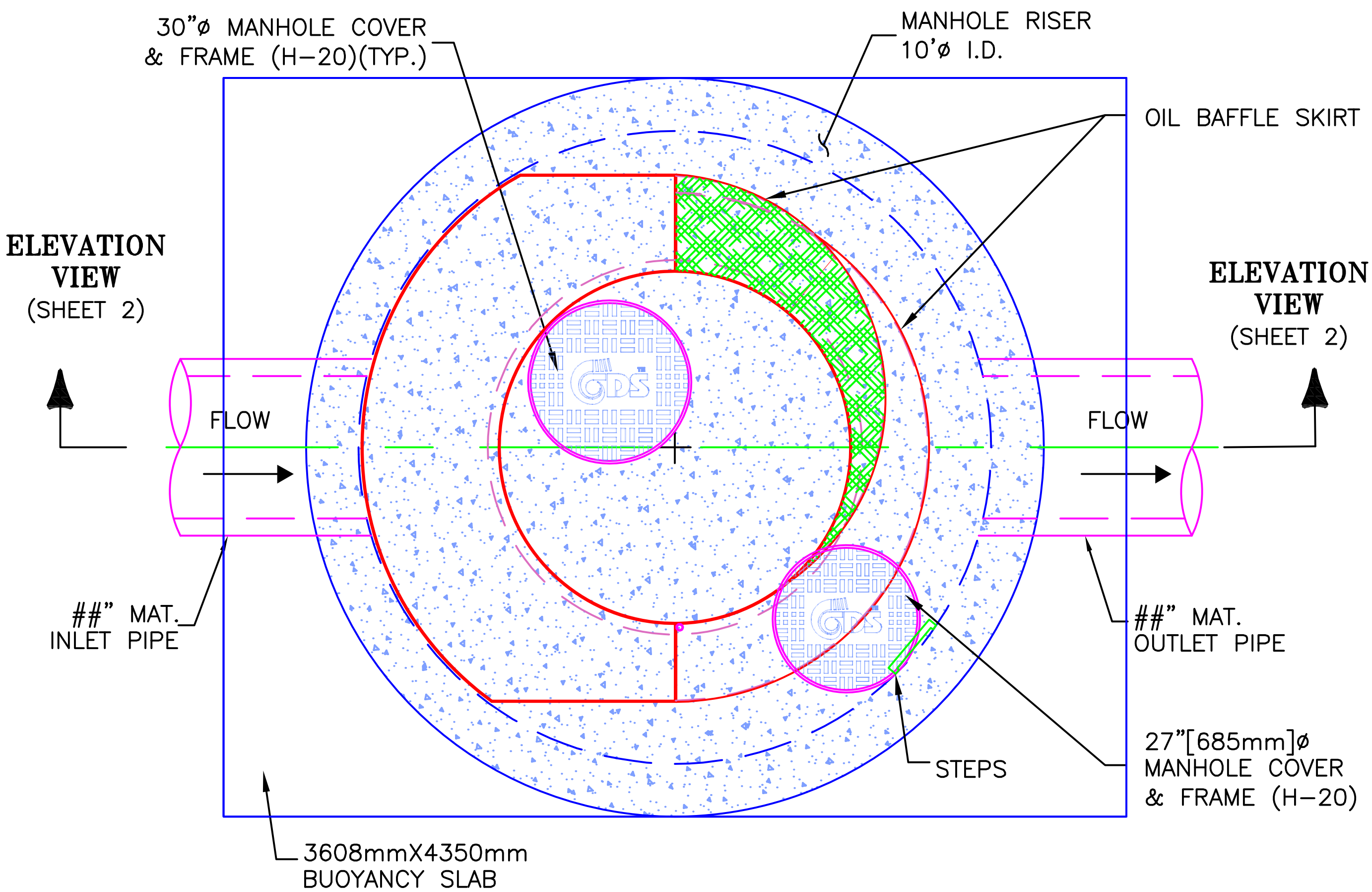
PROJECT NAME

CITY, STATE

JOB#	XX-##-###	SCALE 1" = 3'
DATE	##/##/##	SHEET
DRAWN	INITIALS	2
APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

PLAN VIEW

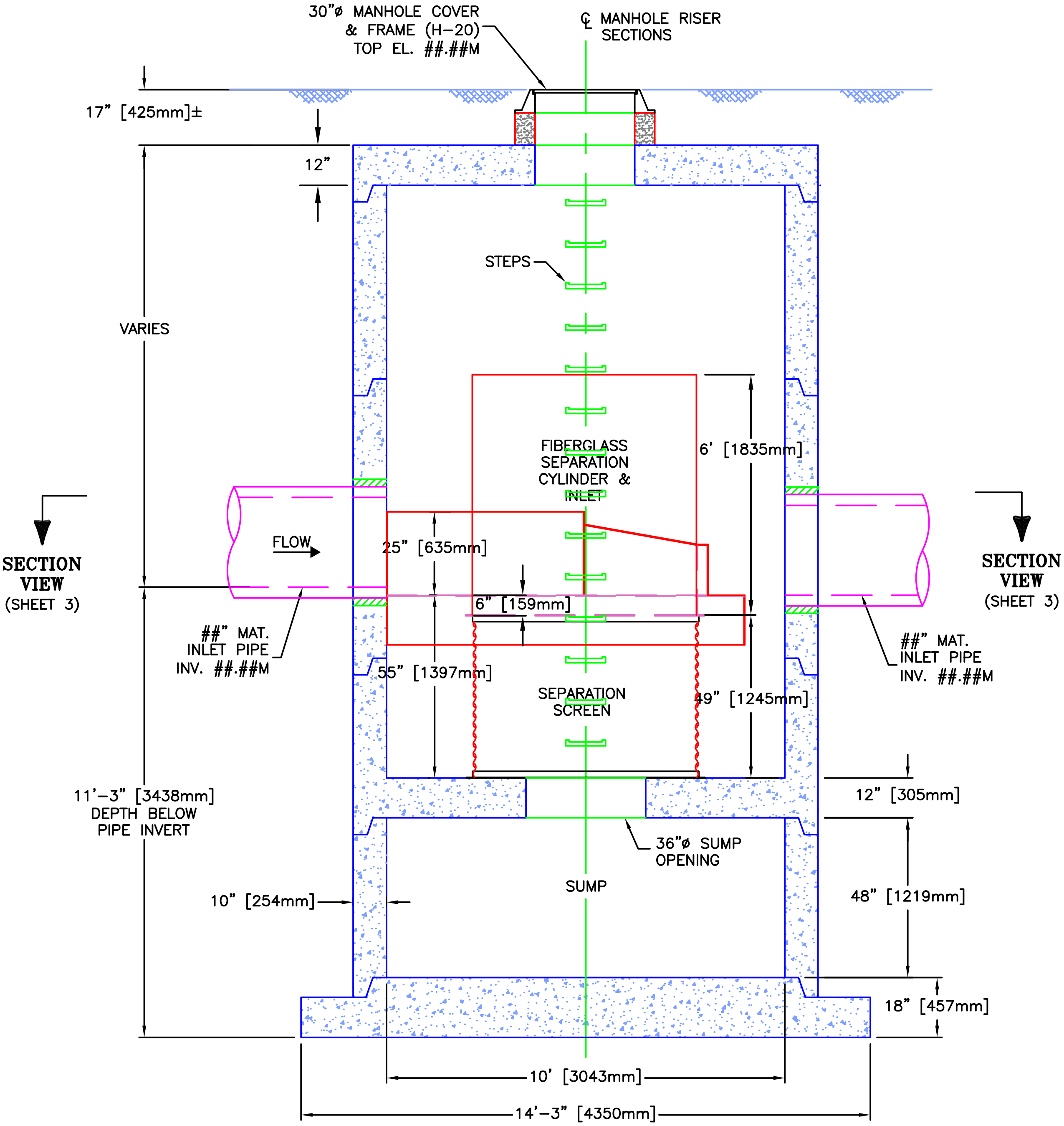


CDS MODEL PMSU56_40m, 9 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX-##-###	SCALE 1" = 3'
		DATE ##/##/##	SHEET
		DRAWN INITIALS	1
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

ELEVATION VIEW



CDS MODEL PMSU56_40m, 9 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

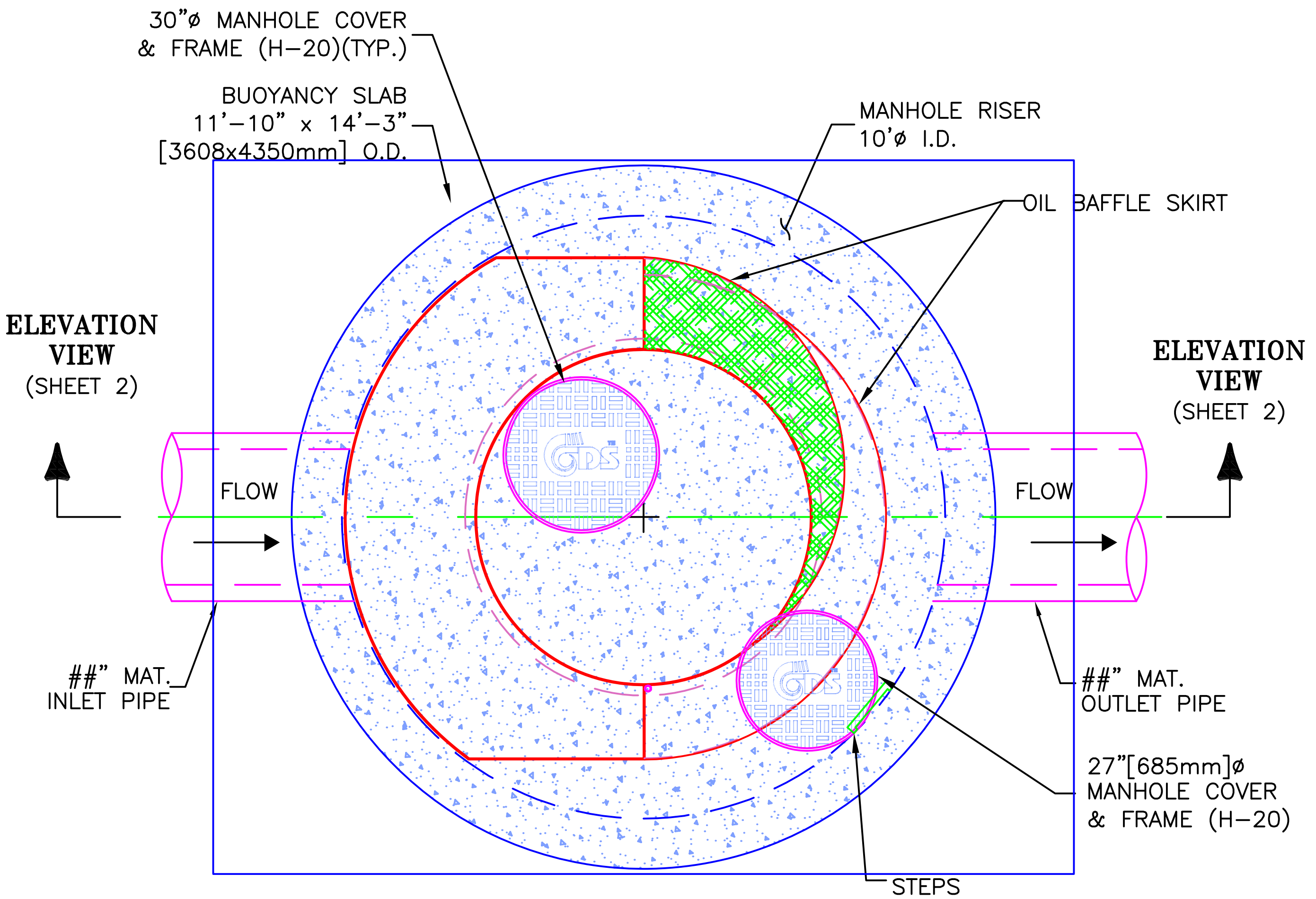
CONTECH STORMWATER SOLUTIONS

PROJECT NAME
CITY, STATE

JOB#	XX-##-###	SCALE 1" = 4'
DATE	##/##/##	SHEET
DRAWN	INITIALS	2
APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

PLAN VIEW

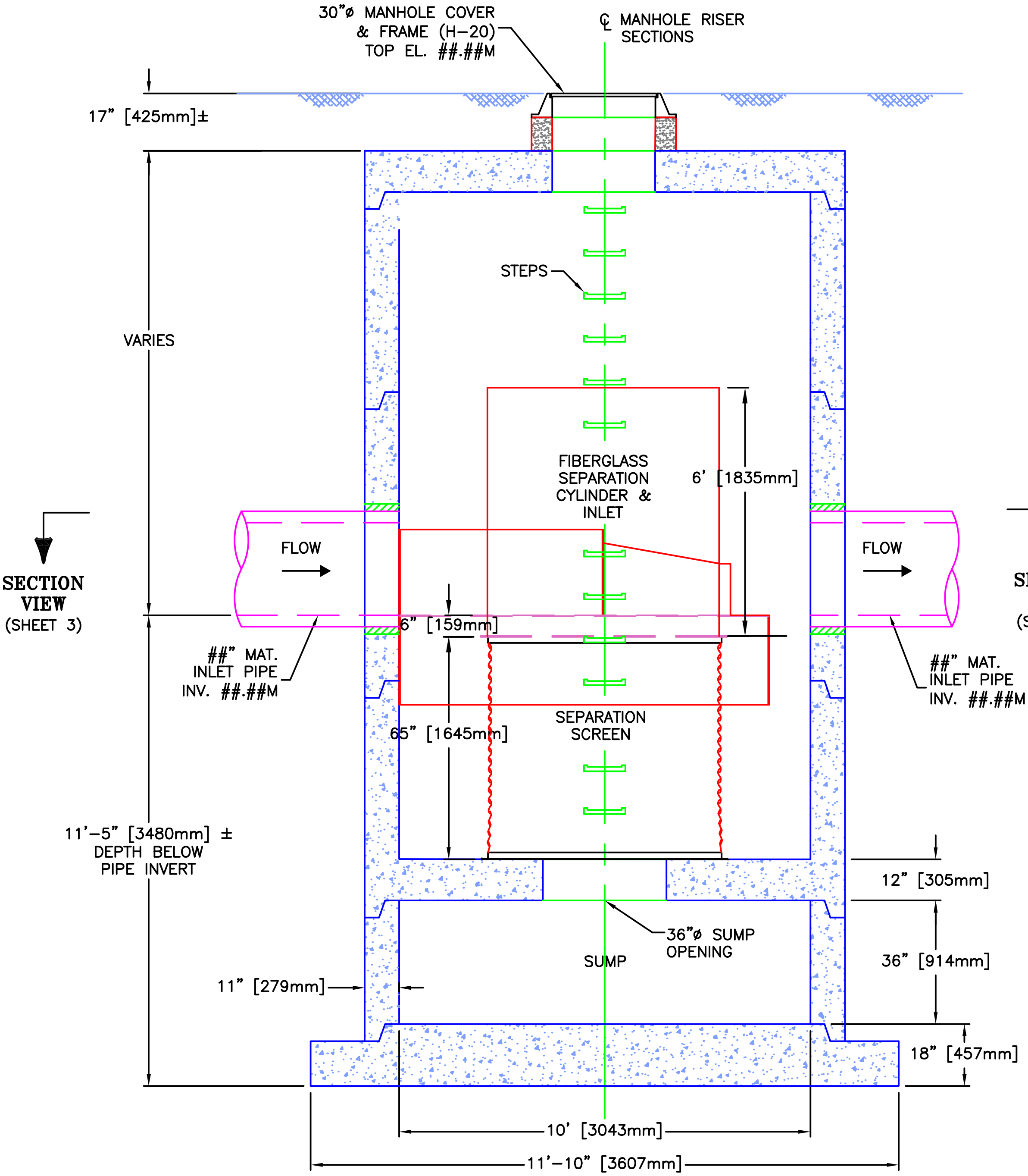


CDS MODEL PMSU56_53m, 396 L/s TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	XX-##-###	SCALE 1" = 3'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	1
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

ELEVATION VIEW



CDS MODEL PMSU56_53m, 396 L/s TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS

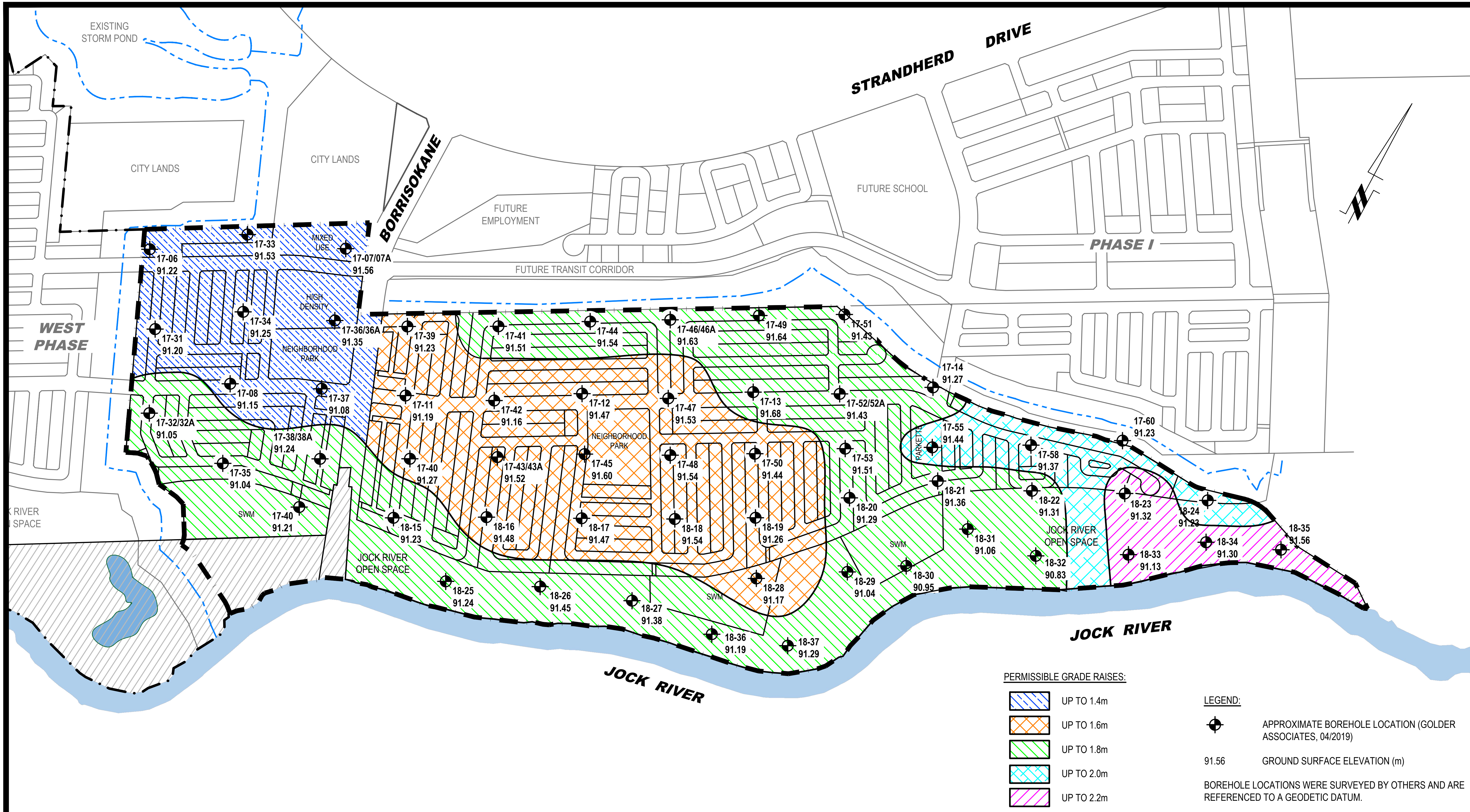
PROJECT NAME
CITY, STATE

JOB#	XX-##-###	SCALE 1" = 4'
DATE	##/##/##	SHEET
DRAWN	INITIALS	2
APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

APPENDIX E

GEOTECHNICAL



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

CAIVAN COMMUNITIES

GEOTECHNICAL INVESTIGATION
PROP. RESIDENTIAL DEVELOPMENT - CONSERVANCY LANDS EAST

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:6000	Date: 09/2019
Drawn by: MPG	Report No.: PG5036-1
Checked by: SD	PG5036-2
Approved by: SD	Revision No.:

11x17

p:\autocad drawings\geotechnical\pg50xx\pg5036\pg5035-1 thlp east land.dwg